

PHARMACEUTICAL INDUSTRY EXPANSION—
"M.C.'s" THIRD ANNUAL SURVEY

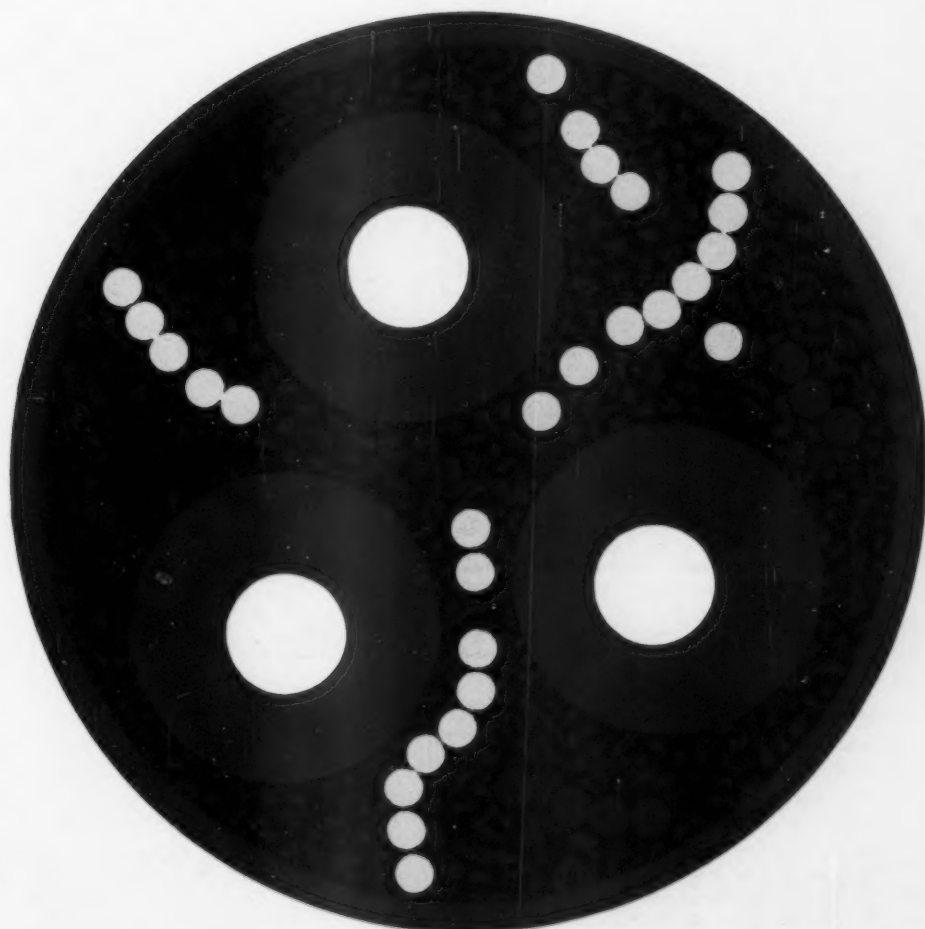
Manufacturing Chemist

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Vol. XXXII No. 5

MAY 1961



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Manufacturing Chemist—May, 1961

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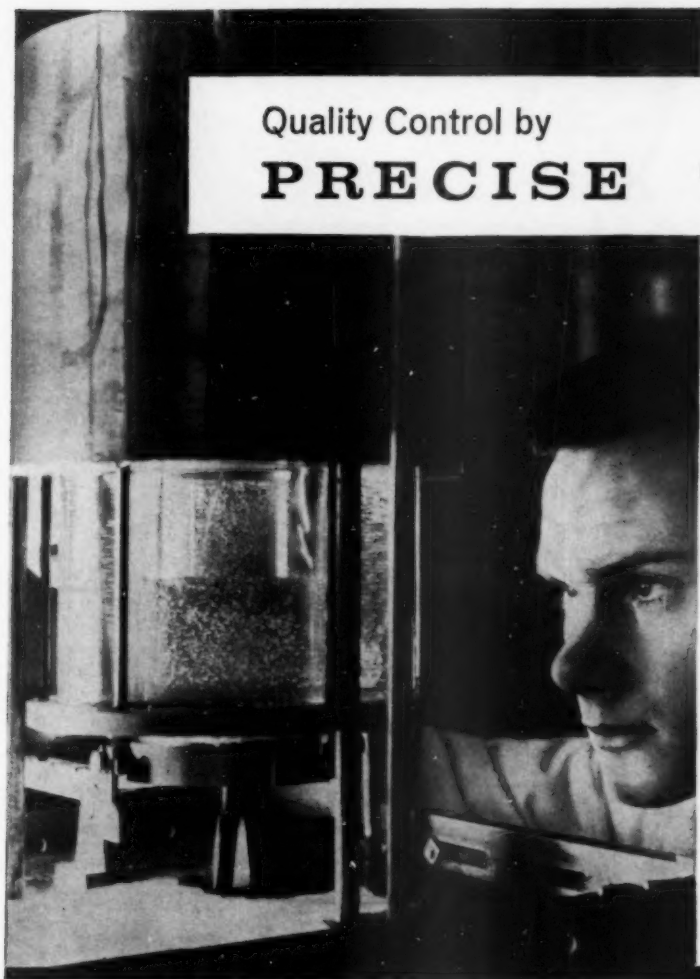
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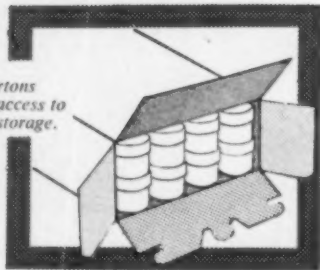
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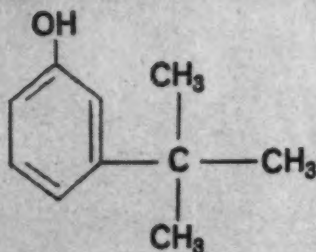
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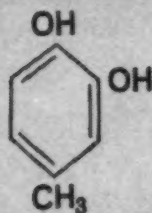
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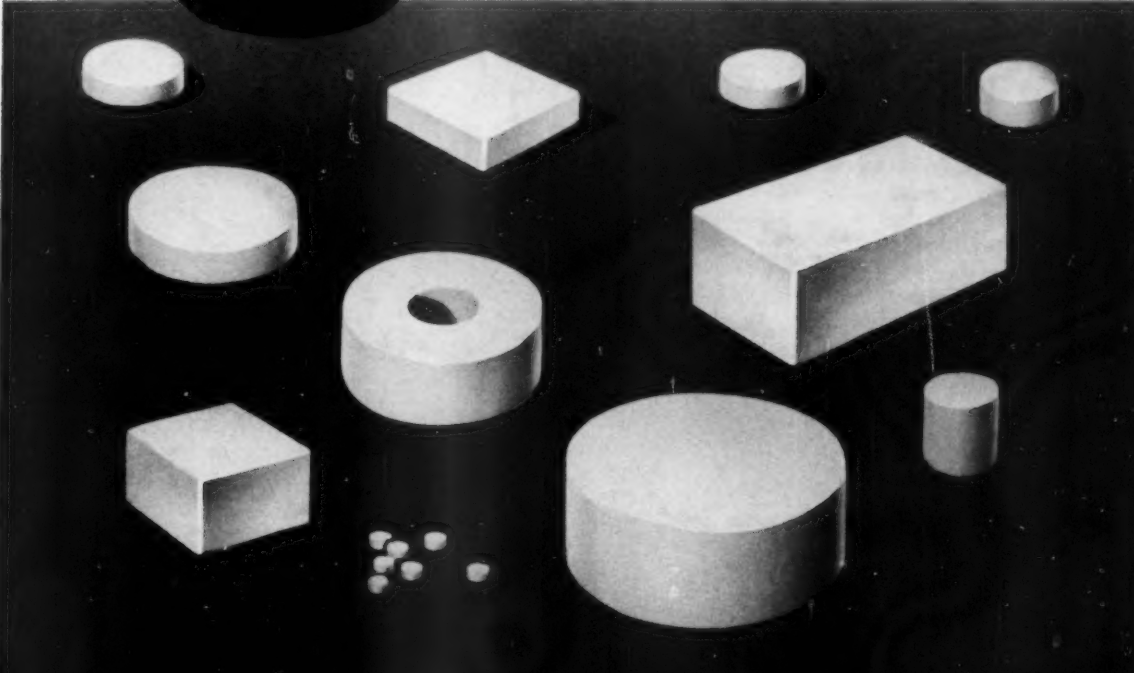
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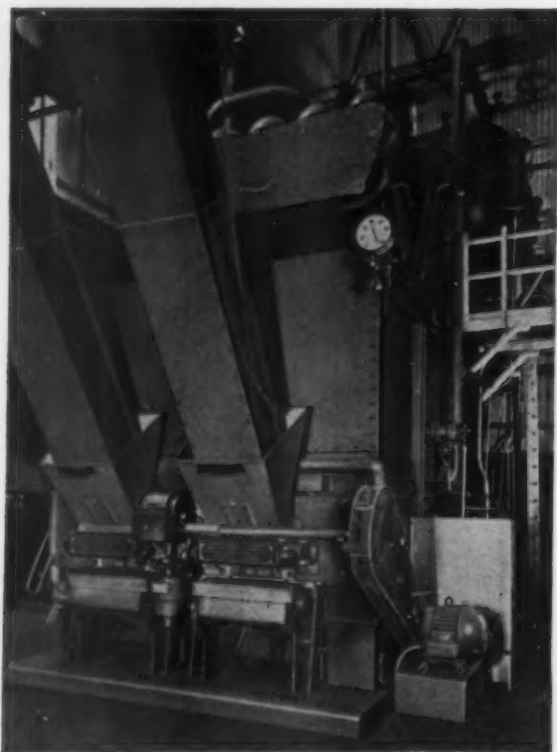
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There are still some chemical plants that handicap their finances with outdated boilerhouses. To modernise other machinery while 'making-do' with inefficient boilers is to throw good money down the drain. Modern coal-burning installations can be so efficient that they will more than pay for themselves in a remarkably short time. They are, without question, the *first* essential in a chemical plant that is going to make rising profits for its management.



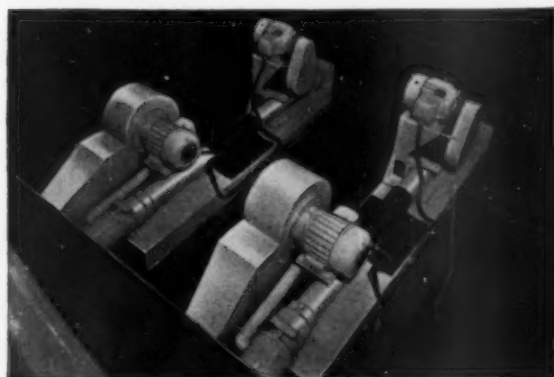
COAL IS THE RELIABLE FUEL

One question for any long-term planning is obvious: can supplies of coal be guaranteed? The answer is yes—without qualification. The mining industry—Britain's *largest single industry* is becoming increasingly efficient; its equipment is the best of its kind. And British coalfields contain enough coal to supply every industrial demand for centuries to come.



COAL IS CLEANER, HOTTER

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COAL



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Make use of the National Coal Board Industrial Finance Plan. The loans are made by Forward Trust Limited, who are members of the Midland Bank Group. A 'phone call or a letter to the Regional office of the National Coal Board will bring you full details.

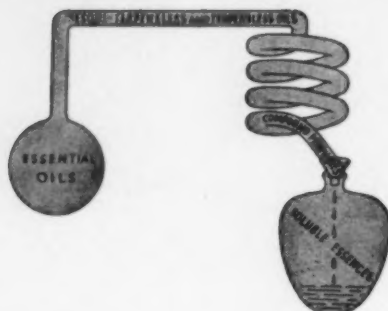
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less cost—and it's British**

ISSUED BY THE NATIONAL COAL BOARD

Manufacturing Chemist—May, 1961

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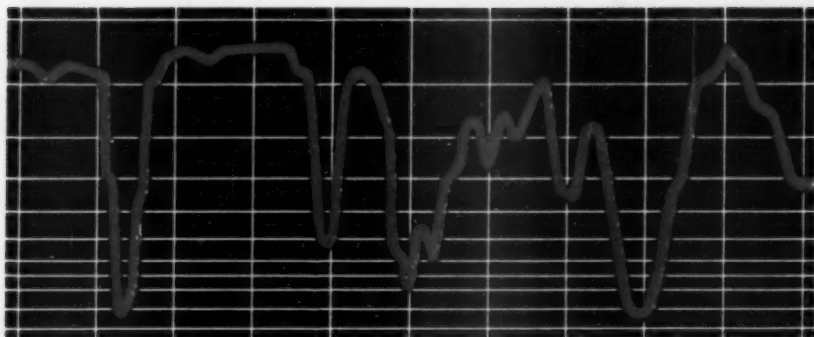
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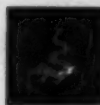
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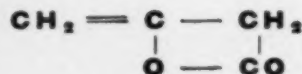
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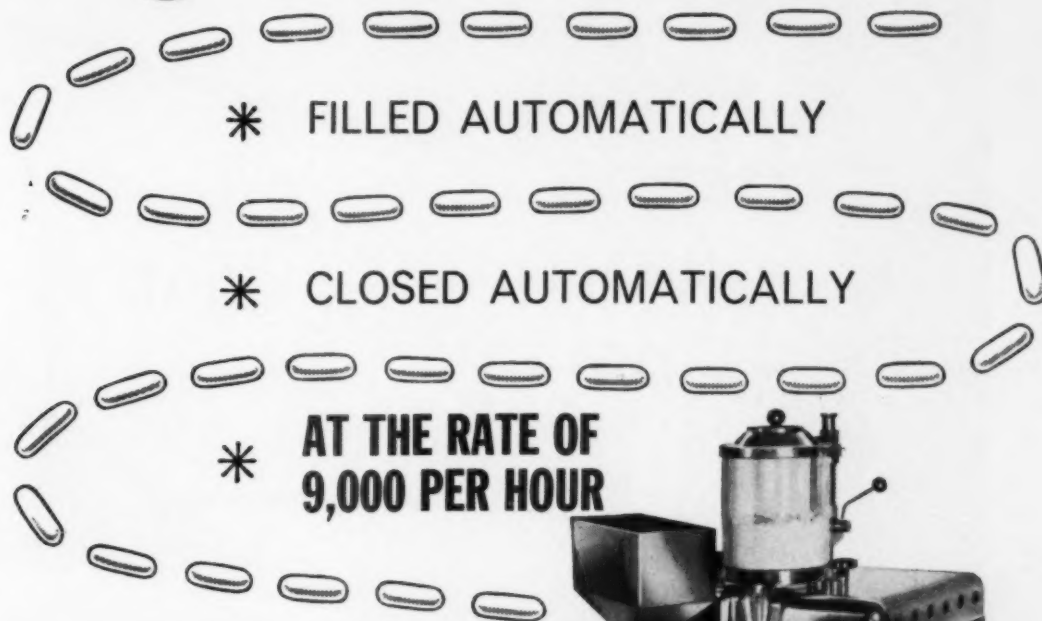


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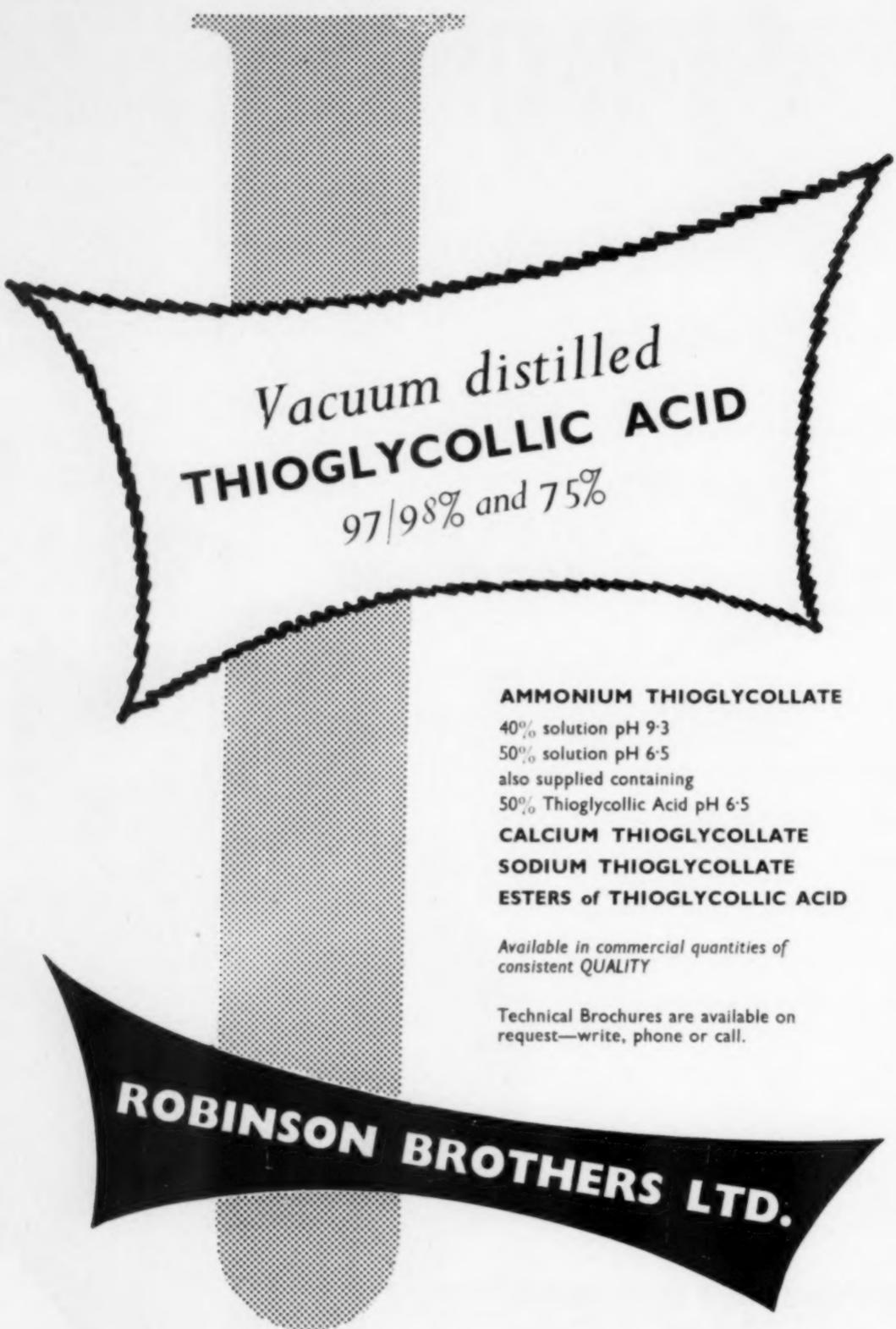
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M-W. 59

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Manufacturing Chemist—May, 1961

A27



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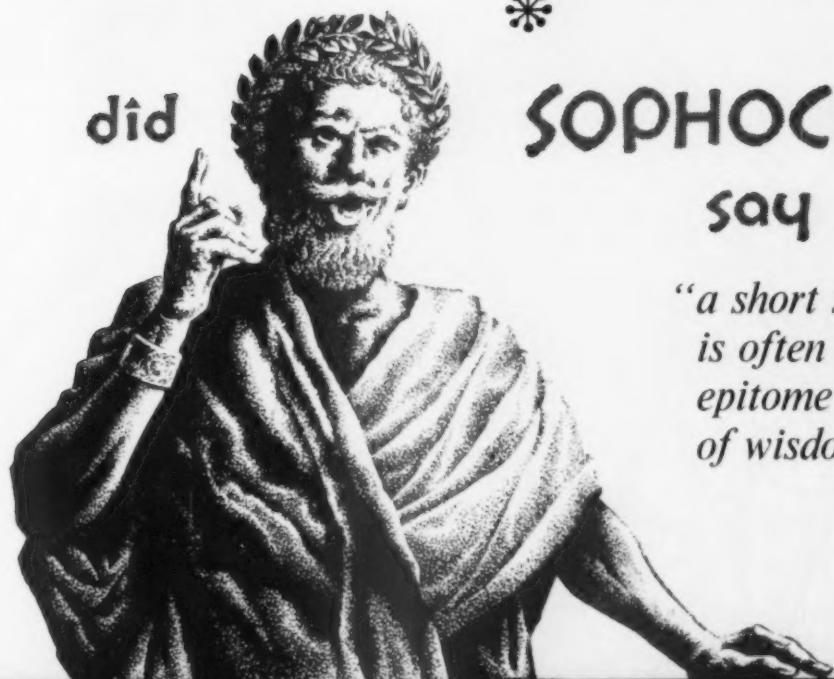
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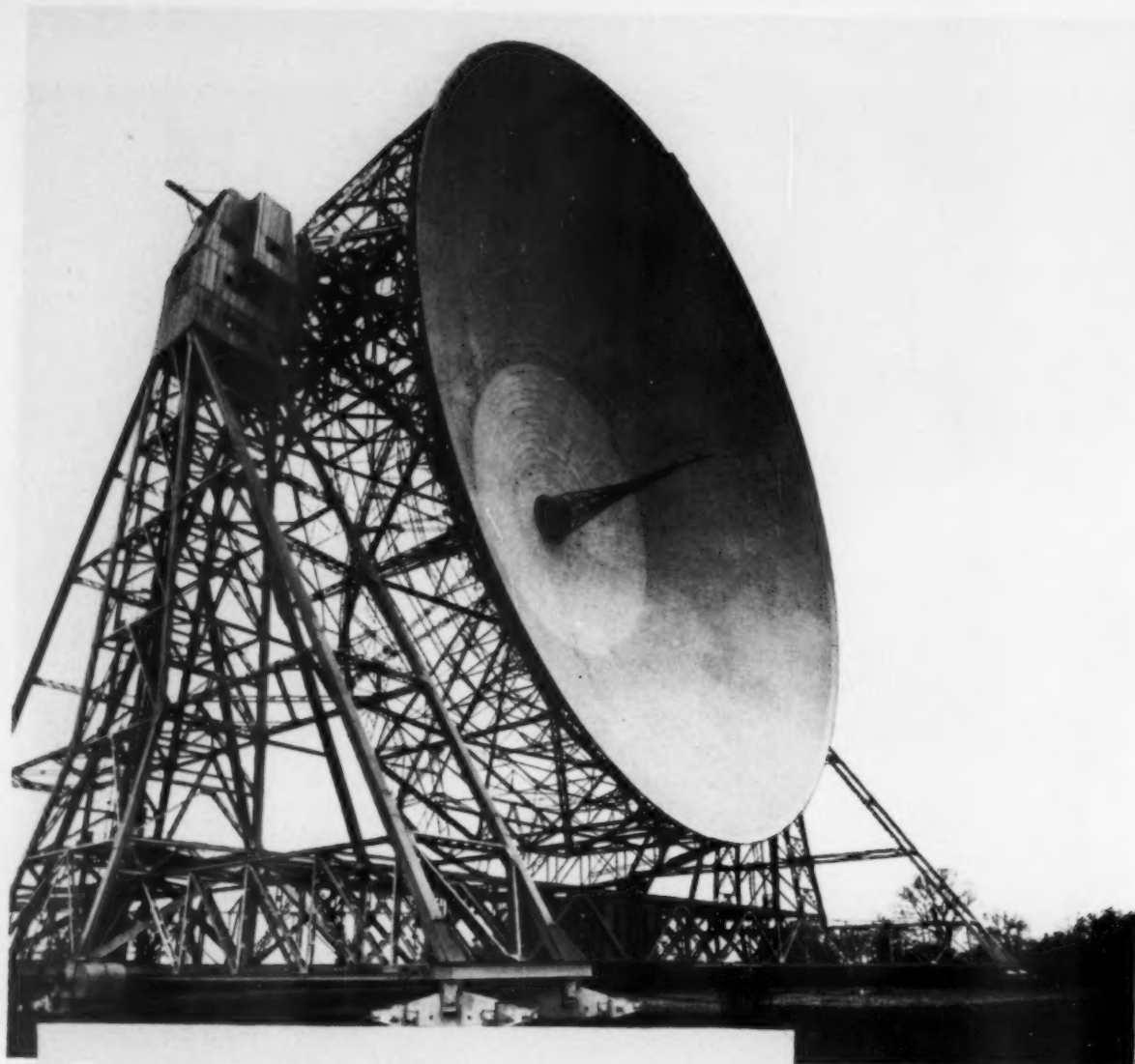
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A30

May, 1961—**Manufacturing Chemist**

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TAS/AL.702

Memo

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Q. What do you mean by increased absorption?

A. Important research work done by Dr. Bacon Chow† (see footnote) of the John Hopkins University in the U.S.A. shows that urinary excretion of radio-active labelled vitamin B₁₂ in STABLETS form is twice as high as ordinary orally administered vitamin B₁₂. The same level of excretion can only be produced, using normal B₁₂, when administered at a level five times greater.

Q. Why is this?

A. Because STABLETS is a specially prepared form of vitamin B₁₂ - it is absorbed on a pharmaceutical grade resin - this enables the essential vitamin to be released in the vital place - the small intestine.

Q. Can you say anything else about STABLETS?

A. Yes - it is remarkably stable. The STABLETS Type I, which we offer as a dry powder containing one per cent vitamin B₁₂, is compatible with the ingredients of a multi-vitamin preparation - no more elaborate manufacturing techniques required; you can even use the wet tableting method. Furthermore, STABLETS can be milled and, since each particle contains some B₁₂, even distribution throughout your product is very much easier to obtain.

Q. How can I find out more about this product?

A. Write for details today to:-

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Chemicals

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† For fuller details, ask for the booklet 'An Absorbing Story'.

CN 11/17200

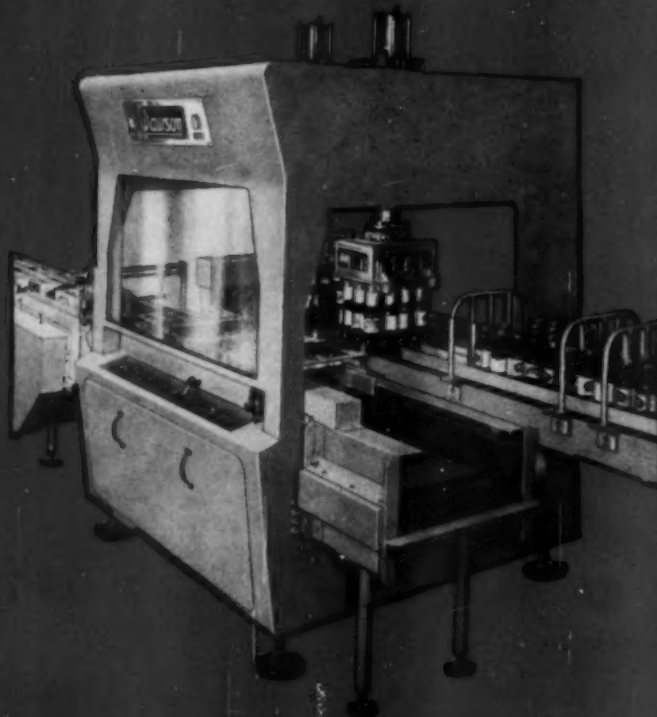


Introducing

the DAWSON automatic carton unpacking machine

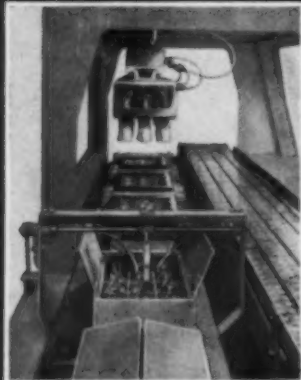
For any range of bottles

- Available with single, double or triple heads to handle up to 24 cartons per minute.
- Air operated for smoother, gentler handling of bottles and cartons.
- Easily changed over from handling one bottle size to another.
- Simple adjustments can be fitted to suit different sized cartons.
- Will handle wood or metal crates as well as cartons.
- Available for remote operation or direct unloading on to the magazine loader of the bottle-washer.
- Operates efficiently on used cartons as well as new ones.
- Exclusive devices fitted for halting cartons in unpacking position and accurately locating them in relation to the grab head. (Patents pending.)
- Automatic safety cut-outs fitted.
- Nylon bottle grippers ensure gentler and safer handling of bottles and closures.
- Operates equally well on bottles with or without closures.

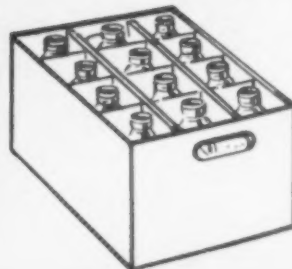
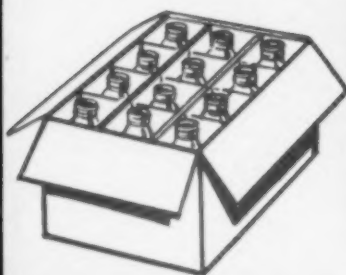


PATENTS PENDING

For Cartons with or without flaps



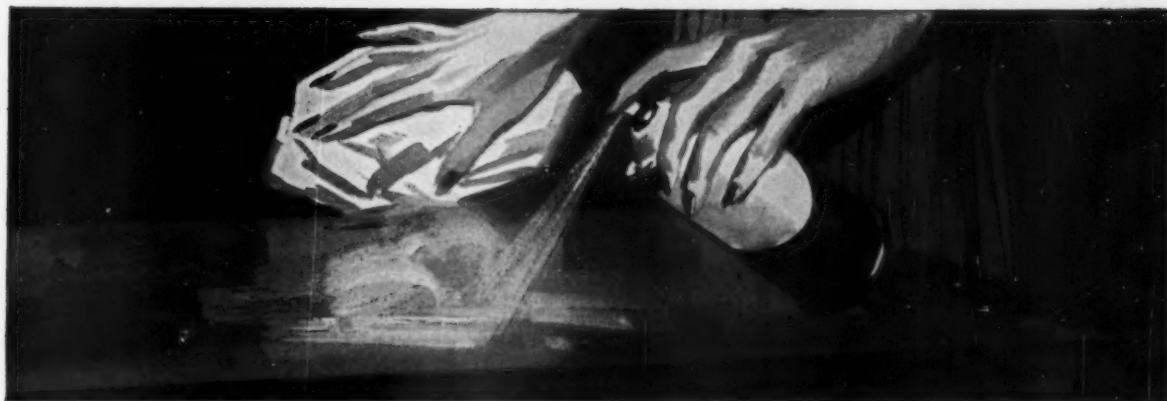
This shows the machine handling cartons with flaps. The plough arrangement in the lower half of the picture can be seen turning the flap back as the carton enters to the unpacking position.



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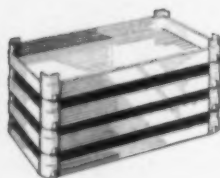
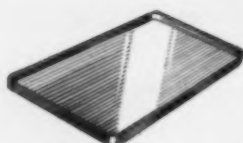
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There are 30 models of the Banks Labelling Machines covering most applications at speeds varying from 20 to 640 bottles per minute. Illustrated is the Cyclone Flat which will apply a label up to five inches in width to square, oval and flat bottles. It can be arranged to apply the label to three sides of the bottle, as illustrated or to the front face only. The bottles to be labelled pass through in a straight line at an uninterrupted speed in a vertical position.

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Manufacturing Chemist—May, 1961

A39



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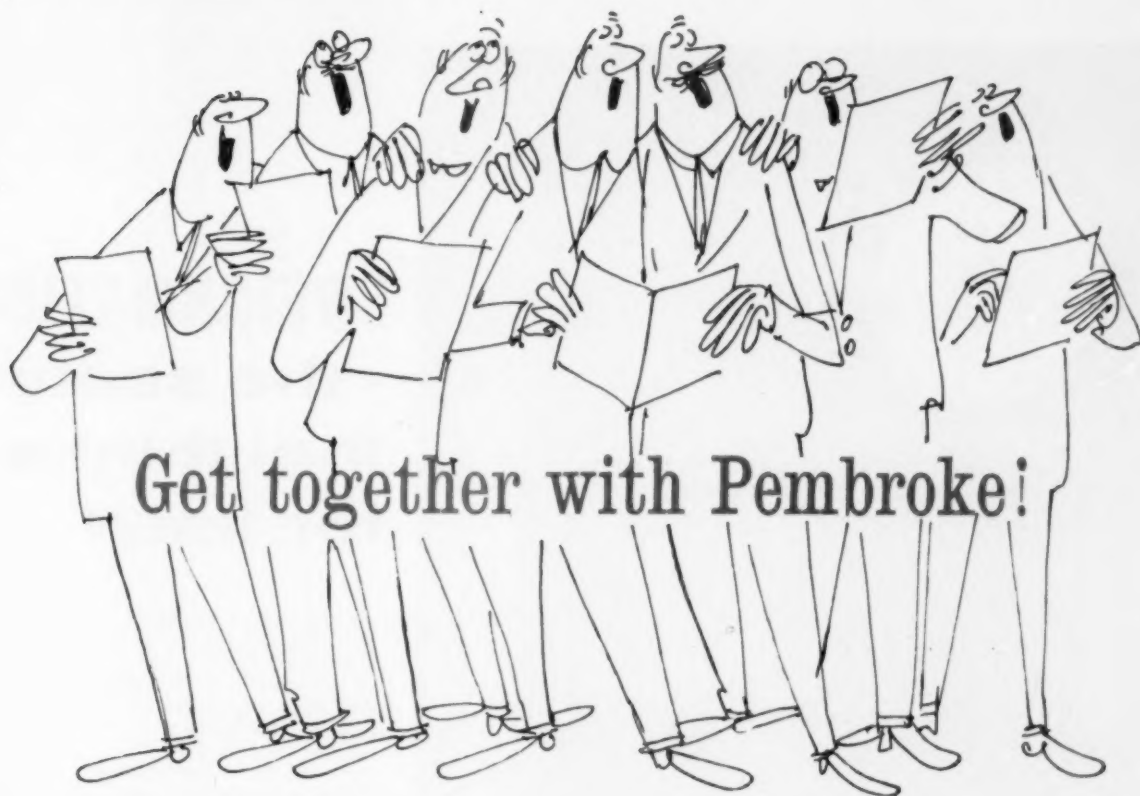
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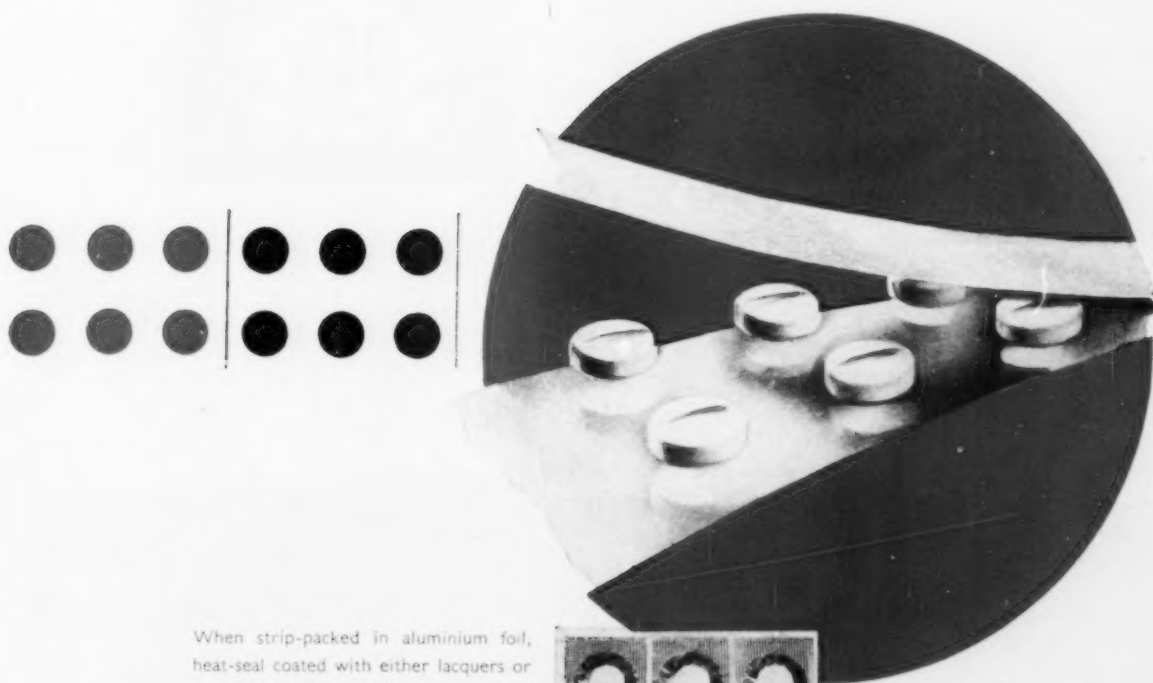
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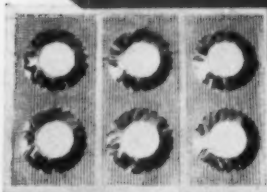
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of light. Manufacturers' own designs,
incorporating dosage instructions, can be
clearly printed by photogravure.



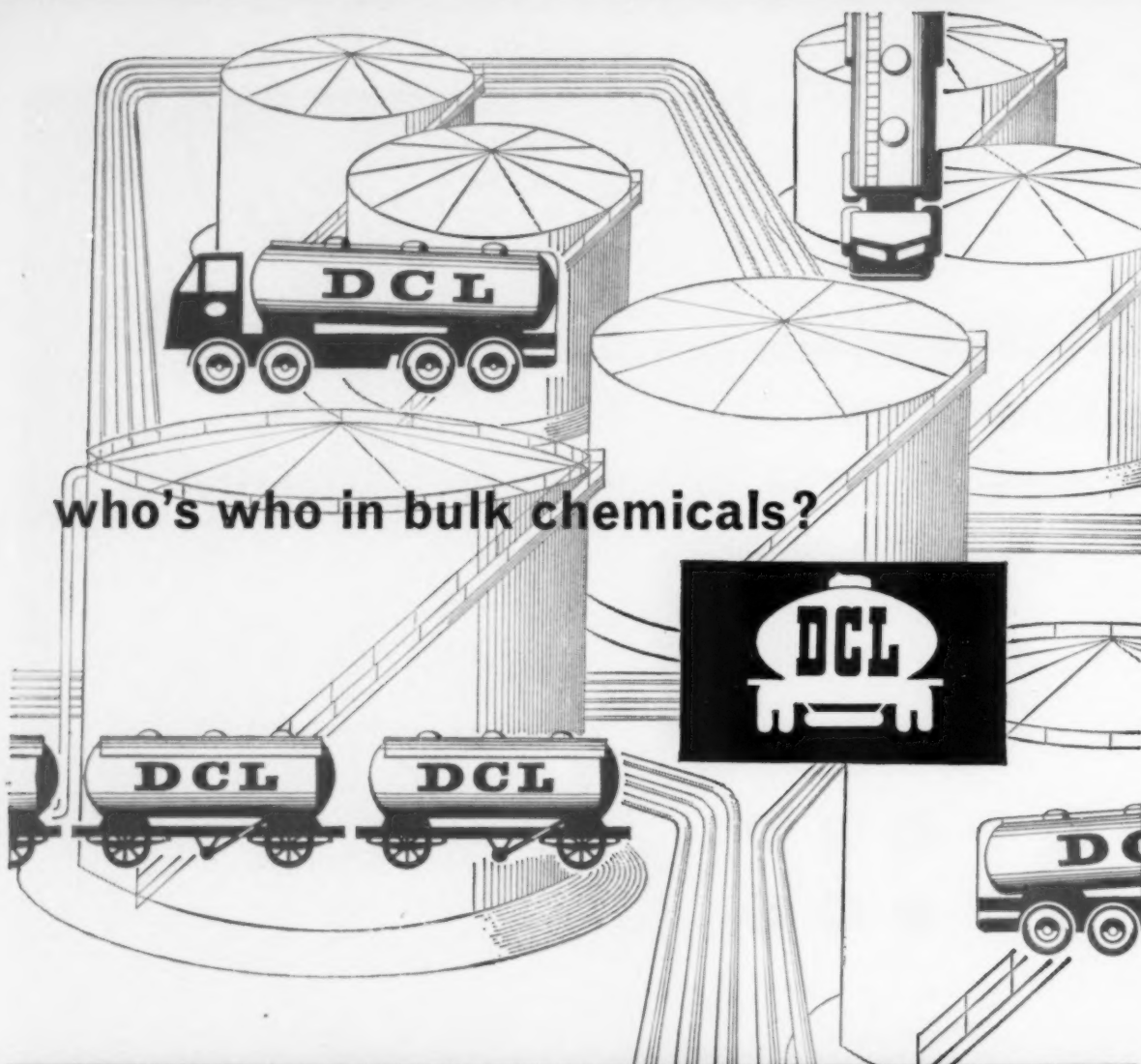
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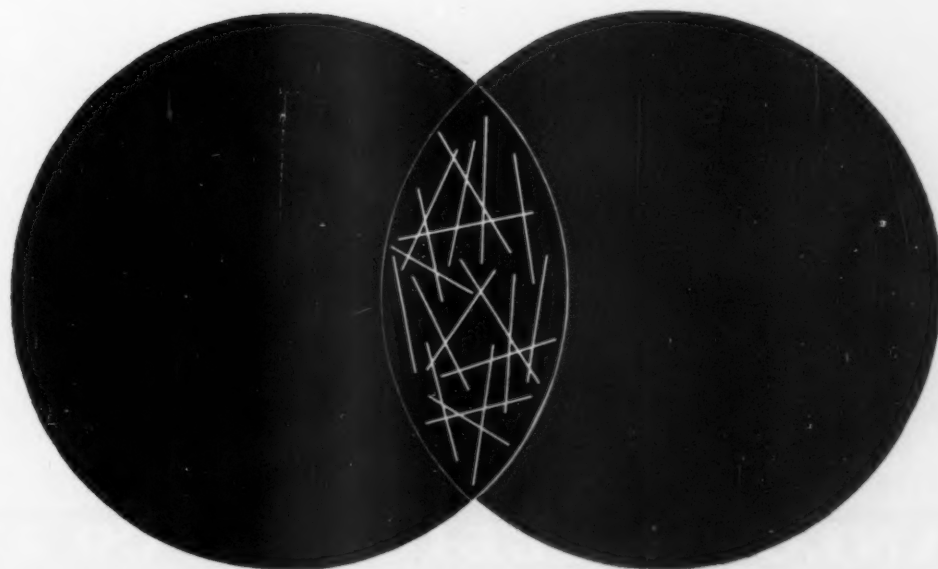
Bisol bulk chemicals include:—

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- ACETONE
- ACETATE ESTERS
- BUTANOL
- DIACETONE ALCOHOL
- M.E.K.
- PHYTHALATES

Union Carbide alkylene amines

The alkylene amines are members of a polymeric series, typified by diethylene triamine. They offer broad applicational opportunities, and will be of particular interest in organic syntheses and heterocyclic ring formation, leading to compounds that will find uses in textile resin finishes, soaps and chelating agents. Write for further technical information on ethylene diamine, diethylene triamine and triethylene tetramine, each of which can be supplied in commercial quantities from stocks held in the United Kingdom.

Propylene diamine is also available for laboratory investigation.



*The term UNION CARBIDE is a trade mark of UNION CARBIDE CORPORATION

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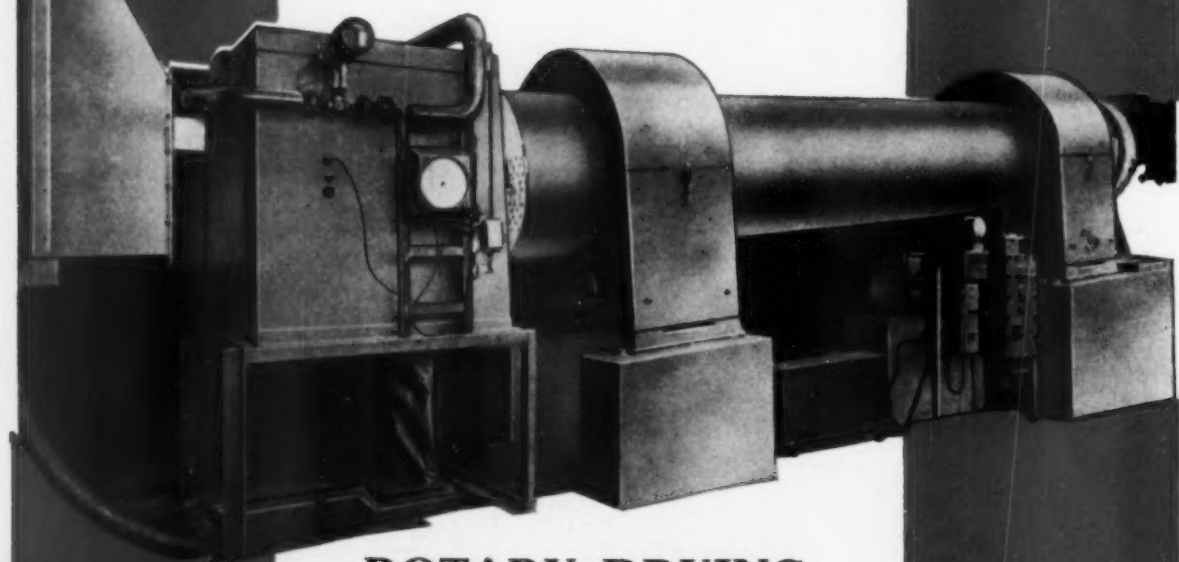
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Manufacturing Chemist—May, 1961

A47

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Development Chemicals from Heavy Organic Chemicals Division



NUMBER TWO

NAME	DESCRIPTION	QUANTITIES AVAILABLE
------	-------------	----------------------

Alcohol

- | | | |
|---------------------|---|-----------------------------------|
| 1 Tridecanol | Liquid. Boiling range 240-257°C. Mixture of isomeric branched-chain C ₁₃ primary alcohols. Uses similar to those of lauryl alcohol as intermediate for surface-active agents. Also intermediate for plasticisers, synthetic lubricants, and oil additives. | 8 oz samples. Tonnage quantities. |
|---------------------|---|-----------------------------------|

Antioxidant

- | | | |
|-----------------------|--|--------------------------|
| 2 'Topanol' CA | Solid. Antioxidant for polymers especially polyolefins, e.g. polypropylene and polymers of ethylene. | Samples in 8 oz bottles. |
|-----------------------|--|--------------------------|

Organic Acids

- | | | |
|---|--|--|
| 3 Nonanoic acid | Liquid. B.Pt. 231-258°C. Essentially 3,5,5-trimethyl hexanoic acid. Intermediate for metal salts for use as specialty paint driers, gelling agents, catalysts, and rot proofing agents. | 8 oz samples. Evaluation quantities up to 10 lb. |
| 4 C ₇ -C ₁₀ acid | Liquid. B.Pt. 238-358°C. Mixture of saturated branched-chain aliphatic monocarboxylic acids. Intermediate for metal salts for use as paint driers, gelling agents, catalysts, and rot proofing agents. | 8 oz samples. Evaluation quantities up to 20 lb. |
| 5 Isophthalic acid | Solid. M.Pt. about 340°C in sealed tube. Intermediate in the production of alkyd resins and high quality polyester resins. Potential plasticiser intermediate. | Samples in 8 oz bottles. Enquiries welcome for cwt lots. |
| 6 Trimellitic anhydride (Product of Amoco Chemicals Corporation U.S.A., supplied by I.C.I. in the United Kingdom only) | Solid. M.Pt. about 168°C. Intermediate for oil-soluble and water-soluble alkyd resins. The trifunctional structure gives high reactivity for production of unsaturated polyesters, plasticisers, and epoxide resins. | Samples in 8 oz bottles. Small evaluation quantities. |

featured for the first time

NAME	DESCRIPTION	QUANTITIES AVAILABLE
------	-------------	----------------------

Phenols

- | | | |
|---|--|---|
| 7 Cumylphenol (p-(α, α-dimethylbenzyl) phenol) | Solid. M.Pt. 72-73°C. Intermediate for special oil-soluble, 100% phenolic resins for surface coatings of outstanding flexibility, durability, and resistance to acids and alkalis. | Samples in 8 oz bottles. |
| 8 2,5-Xylenol (technical) | Solid. M.Pt. 60-70°C. Contains 80-90% by weight 2,5-Xylenol. Intermediate for varnish resins, plasticisers, adhesive resins, weedkillers, and antiseptics. | Samples in 8 oz bottles. Quantities up to 1 ton from stock; larger quantities by arrangement. |

Butylated Phenols

- | | | |
|--|---|--|
| 9 3-Methyl-, 6-ditertiary butylphenol (3M46B) | Solid, M.Pt. 56-58°C (technical quality). Intermediate for products used in the rubber and plastics industries. Other specialised uses. | Samples in 8 oz bottles. Tonnage quantities. |
| 10 3-Methyl-6-tertiary butylphenol (3M6B) | Solid, M.Pt. 21-22°C (refined quality). Rubber chemical. Intermediate for rubber chemicals and synthetic perfumes, e.g. musk ambrette. | Samples in 8 oz bottles. Tonnage quantities. |

Propylene Derivatives

- | | | |
|--|---|---|
| 11 Propylene dichloride (1,2-dichloropropane) | Liquid. B.Pt. about 96°C. Solvent for fats, waxes, and organic products. Chemical intermediate. | 8 oz samples. Ton lots. |
| 12 Dichlorodisopropyl ether | Liquid. B.Pt. about 167°C. Solvent for fats, waxes, and organic products. Chemical intermediate. | 8 oz samples. 45 gal drum lots. |
| 13 Dipropylene glycol | Liquid. B.Pt. about 232°C. Polyester resin intermediate. Solvent, humectant, component in hydraulic fluids, and plasticiser for cork and paper. | 8 oz samples. Evaluation quantities by arrangement. |

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6	7	8	9
10	11	12	13

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*
Anisic Acid * Benzhydrol
*
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*
N:N'-Disalicylidenepropylenediamine
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Ethyl Benzoylacetate
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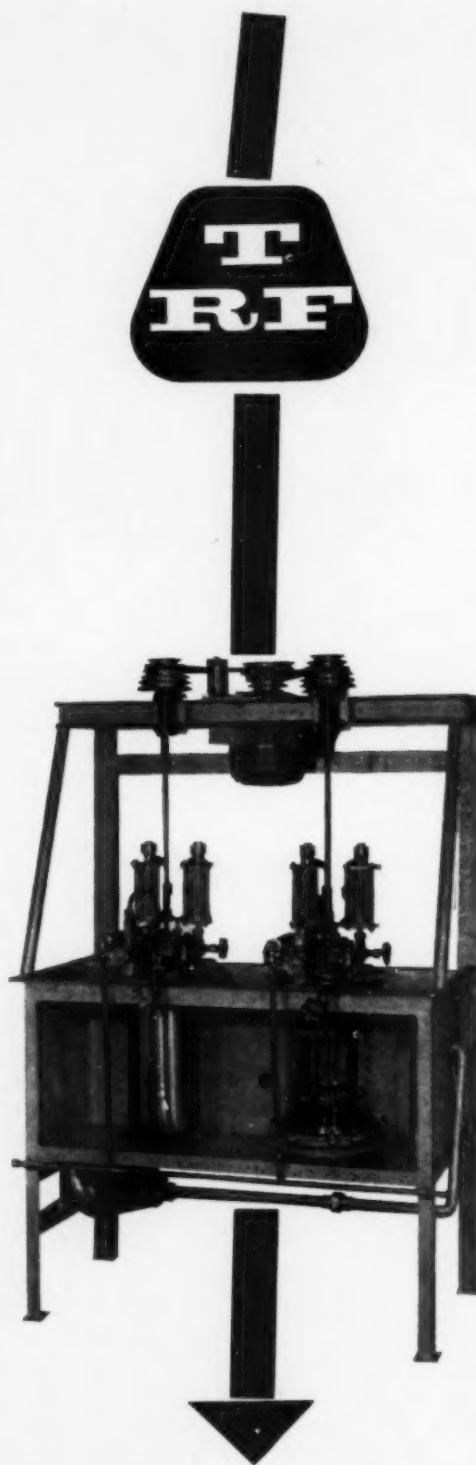
Take, for instance, the illustrated fermenter, showing alternative glass and stainless steel vessels, and based on a design by Professor E. B. Chain, F.R.S., the microbiology specialist. To T.R.F., the experts in stainless steel planning and production, this was yet another problem which called for their individual skills . . . the same skills which they can apply to *your* equipment problems. Better get in touch with them, soon!

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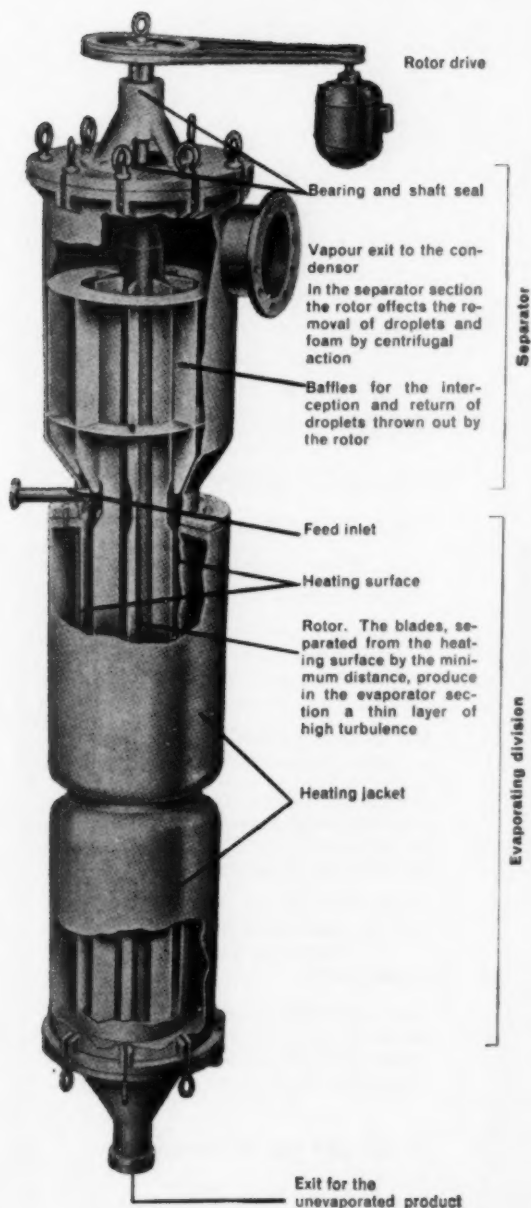
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Manufacturing Chemist—May, 1961

A53



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Aconitine crystals	Dimethyl-methylsuccinate	Methylsuccinic acid
beta-Alanine	2,7-Dimethyl-2,7-octanediol	*3-Methyl thiophene
Aminoacetal	2,4-Dimethyl-3-pentanol (Di-isopropylcarbinol)	Methyltuberate
meta-Aminobenzotrifluoride	3,3-Dimethylpiperidine	Myristonitrile 99% (n-Tridecylcyanide)
1,4-(bis-Aminomethyl)cyclohexane	2,5-Dimethylpyrrole	Nitrocyclohexane
9-Anthracene aldehyde	2,4-Dimethyl resorcinol	5-Nitro-2-furfuraldehyde diacetate
Arachyl alcohol 99%	2,5-Dimethyltetrahydrofuran (water free)	5-Nitrofururylidene diacetate
Behenic Acid	Dimethyl thapsate	o-Nitrophenylacetic acid m.p. 138°C
Behenyl alcohol 90%	Di-n-octylamine 99%	Nonamethylenedinitrile
Behenyl alcohol 98%	n-Docosane 95%	Nonanediol-1,9
Benzidine acetate	1-Docosene 95%	5-Nonanol (Di-butylcarbinol)
Benzyl ethyl carbinol	Dodecahydro-beta-naphthyl acetate	n-Nonylamine 99%
Benzyl iodide	n-Dodecane 99% (Olefin free)	n-Nonylcyanide 99%
Benzyl isothiocyanate	1-Dodecene 95%	n-Octadecane 99% (olefin free)
Benzyl mercaptan	n-Dodecylamine 99%	1-Octadecene 95%
Bornyl benzoate	2,2-Diphenylethylamine-1	n-Octadecylamine 99%
2-Bromoheptane	n-Eicosane 95%	iso Octanoic acid
3-Bromoheptane	1-Eicosene 95%	Octamethylenedinitrile
4-Bromoheptane	1, 2-Ethanedithiol	Octamethylene-imine
p-Bromophenacyl bromide	4-Ethoxy-3-methoxy benzaldehyde	n-Octane 99% (Olefin free)
1-Bromo-3-propanol	2-Ethyl-1-butene 95%	1-Octene 95%
Butadiene sulphone	Ethyl-4-chloro-2-methylphenoxy acetate	2-Octene 95%
Butene-2-diol-1,4	6-Ethyldecanol-3	1,8-Octolactam
Calcium galactonate	(Ethyl-(3-ethyl)-heptylcarbinol)	iso Octylamine
Calcium glucoheptonate	5-Ethylheptanol-2	tri iso Octylamine
Calcium glycerate	(Methyl-(3-ethyl)-pentylcarbinol)	di iso Octylamine
Capricitrile 99%	2-Ethyl-1-hexene 95%	n-Octylamine 99%
Caprylnitrile 99%	5-Ethylnonanol-2	Palmitonitrile 99% (n-Pentadecylcyanide)
Carbazole (very pure)	(Methyl-(3-ethyl)-heptylcarbinol)	Pentadecane (traces Tetradecane)
Cephalin (ex Hog's Brain) pure	6-Ethylloctanol-3	n-Pentadecylamine 99%
Cerium salicylate	(Ethyl-(3-ethyl)-pentylcarbinol)	n-Pentadecylamine pure
ortho-Chlorobenzyl chloride	Eugenyl methyl ether	Pentamethylenedinitrile
6-Chloro-hexanol-1	Ferric tartrate pure	Pentanol-3 (Diethylcarbinol)
3-Chloro-propanol-1	Furfuryl acetate	2-Pentyne
2-Chloro-pyridine	Furoic acid 98% & 99-8%	Phenanthrene-9-aldehyde
Colchicine USP XIV	Glyceryl-para-aminobenzoate	2-Phenylamino-pyridine
Copper guaiscol sulphate	Heptamethylenedinitrile	(2-Anilino-pyridine)
Cupric dibenzene sulphate hexahydrate	2,2,4,4,6,8,8-Heptamethylnonane 95%	1-Phenylbutanol-2
Cyclodecanone semicarbazone	n-Heptane 99% (Olefin free)	beta-Phenylethyl iodide
Cyclododecane	n-Heptanol-2 (Methyl pentylcarbinol)	beta-Phenylethyl isocyanate
Cyclododecanol	Heptanol-3	beta-Phenylethyl isothiocyanate
Cycloheptane	Heptanol-4 (Di-n-propylcarbinol)	Phenyl isopropyl aldehyde
Cycloheptanol	1-Heptene 95%	3-Phenylpropylamine-1
Cycloheptanone	n-Heptadecylamine pure	beta gamma Phenylpropylthylamine Base
Cycloheptylamine	n-Heptylamine 99%	beta gamma Phenylpropylthylamine dihydrogen
Cyclohexane-1,4-biscarbinol	n-Hexadecane 99% (Olefin free)	citrate
Cyclohexyl urea	1-Hexadecene 95%	3-Piperidino-propionitrile
Cyclooctanol	n-Hexadecylamine 99%	3-Piperidino-propylamine-1
Cyclooctanone	Hexahydrobenzaldehyde	Potassium cresote sulphate
Cyclooctanone isoxime	Hexahydrobenzyl alcohol	Potassium mercaptophenyl-thio-thiodiazolone
Cyclooctylamine	(Cyclohexane methanol)	1, 3-Propanedithiol
Cyclopentyl urea	Hexahydro-p-xylyldiamine	3-Pyrrolidino-propionitrile
Cyclopentylamine	Hexamethylenedinitrile	3-Pyrrolidino-propylamine-1
Decahydrocinnamic aldehyde	Hexamethylene-imine	Resorcinol diethyl ether
Decahydro-beta-naphthyl acetate	3-Hexamethylene-imino-propionitrile	Salicyloyl hydrazide
beta-Decalol (cis/trans mixed)	3-Hexamethylene-imino-propylamine	Salicylhydroxamic acid
Decamethylene-1,10-dicarboxylic acid	n-Hexane 99% (Olefin free)	Sebacyl dichloride COCl(CH ₂) ₈ COCl
Decamethylenedinitrile	Hexanediol-1,6	Serotonin creatinine sulphate
n-Decane 99% (Olefin free)	Hexanediol-2,5	Sodium dichloroacetic acid
Decanediol-1,10	Hexanol-2 (Methyl-n-butylcarbinol)	Sodium phytate
1-Decene 95%	Hexanol-3 (Ethyl-propylcarbinol)	Sphingomyelin (ex cerebro)
n-Decylamine 99%	1-Hexene 75%	Stearonitrile 99% (n-Heptadecylcyanide)
Diaminododecane-1,10	Hexylcinnamic aldehyde	trans-Stilbene
Diaminododecane-1,12	1-Hexyne	Suberic acid
Diaminoheptane-1,7	2-Hexyne	Tarphthalaldehyde
Diaminononane-1,9	3-Hexyne	Terpineol iodide
Diaminooctane-1,8	Lanthanum salicylate	Terpineol saponate
Diaminoundecane-1,11	Lauroitrile (n-Undecylcyanide)	Terpineol isothiocyanate
1,4-Dibromobutene-2	beta-Mercaptoethylamine HCl	n-Tetradecane 99% (Olefin free)
Dibromodecane-1,10	Mercury acetamide	1-Tetradecene 95%
Dibromohexane-1,6	Mercuric succinimide	n-Tetradecylamine 99%
Dibromononane-1,9	5-Methoxy-1-chloropentene-2	Tetrahydrofurfuryl salicylate
Dibromooctane-1,8	5-Methoxy-3-chloropentene-1	Tetrahydropyran
Dibromopentane-1,5	6-Methylcoumarin	Theophylline-7-acetic acid
Dichlorodecane-1,10	3-Methylcyclopentanediol-1,2	Thioacetamide
Dichlorohexane-1,6	Methyl cyclopentylamine	Thiosalicylic acid m.p. 160°C +
2,3-Dichloro-1,4-naphthoquinone	3-Methyl-5-ethyl-heptanediol-2,4	Triamyl citrate
Dichloropentane-1,5	3-Methyl-5-ethyl-nonanediol-2,4	Trichlorodimethylphenylcarbinol acetate redist
Dicyclopentadienyliron	2-Methyl-7-ethylnonanol-4	Trichlorohexahydro-beta-naphthol
Dicyclopentylamine	3-Methyl-(3-ethyl)-pentylcarbinol	n-Tridecylamine 99%
Di-n-decylamine	(Isobutyl-3-ethyl)-pentylcarbinol	Trimellitic anhydride
Di-n-dodecylamine	3-Methylheptane 95%	2,6,8-Trimethyl-4-nonanol
Didymium salicylate	3-Methylheptanediol-2,4	Tri-n-octylamine 90/95% & 99%
Diethanolamine salt of maleic hydrazide	3-Methylheptanol-2	d1-Tryptophane pharmaceutical
asym-Diethyl ethylenediamine	(Methyl-(1-methyl)-pentylcarbinol)	L-Tyrosine
Diethyl suberate	3-Methylheptanol-5	2-Undecanol (Methylnonylcarbinol)
N-Diethyl amino acetonitrile	2-Methylpentanediol-1,3	6-Undecanol (Di-amylcarbinol)
*1,5-Dihydroxy naphthalene	3-Methylpentanediol-2,4	n-Undecylamine 99%
*2,7-Dihydroxy naphthalene	3-Methylpentanol-2	Varian Blue Indicator
2,3-Dimercaptopropanol	(Methyl-(1-methyl)-propylcarbinol)	
2,2-Dimethyl-diaminopentane-1,5	2-Methyl-1-pentene 95%	

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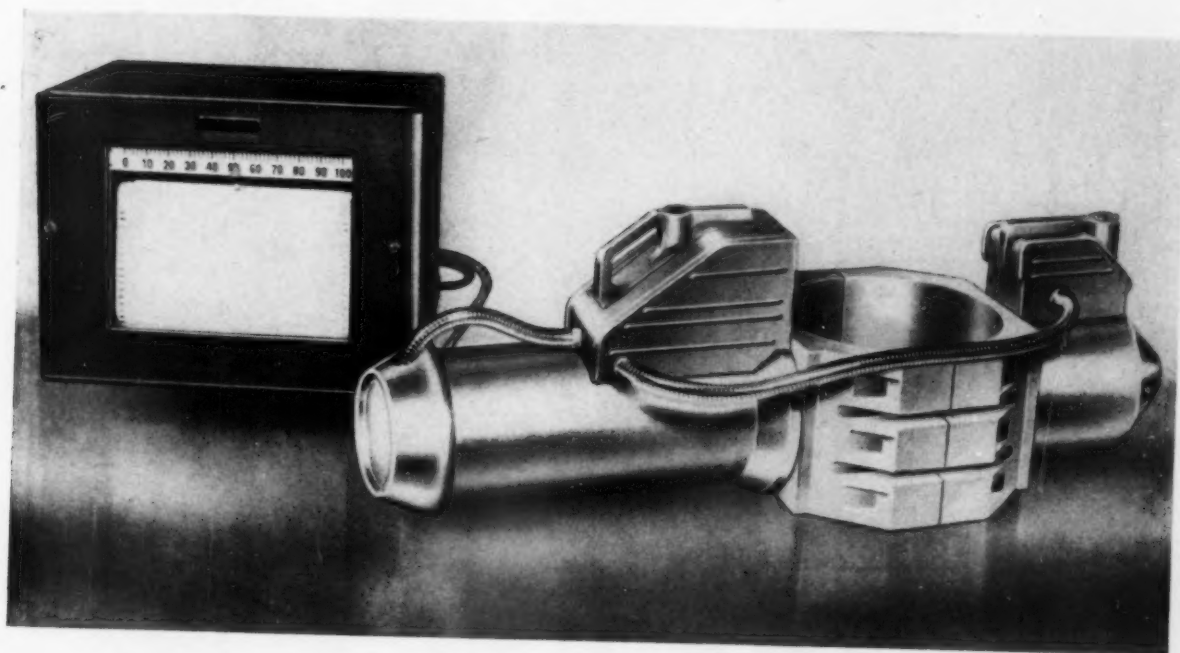
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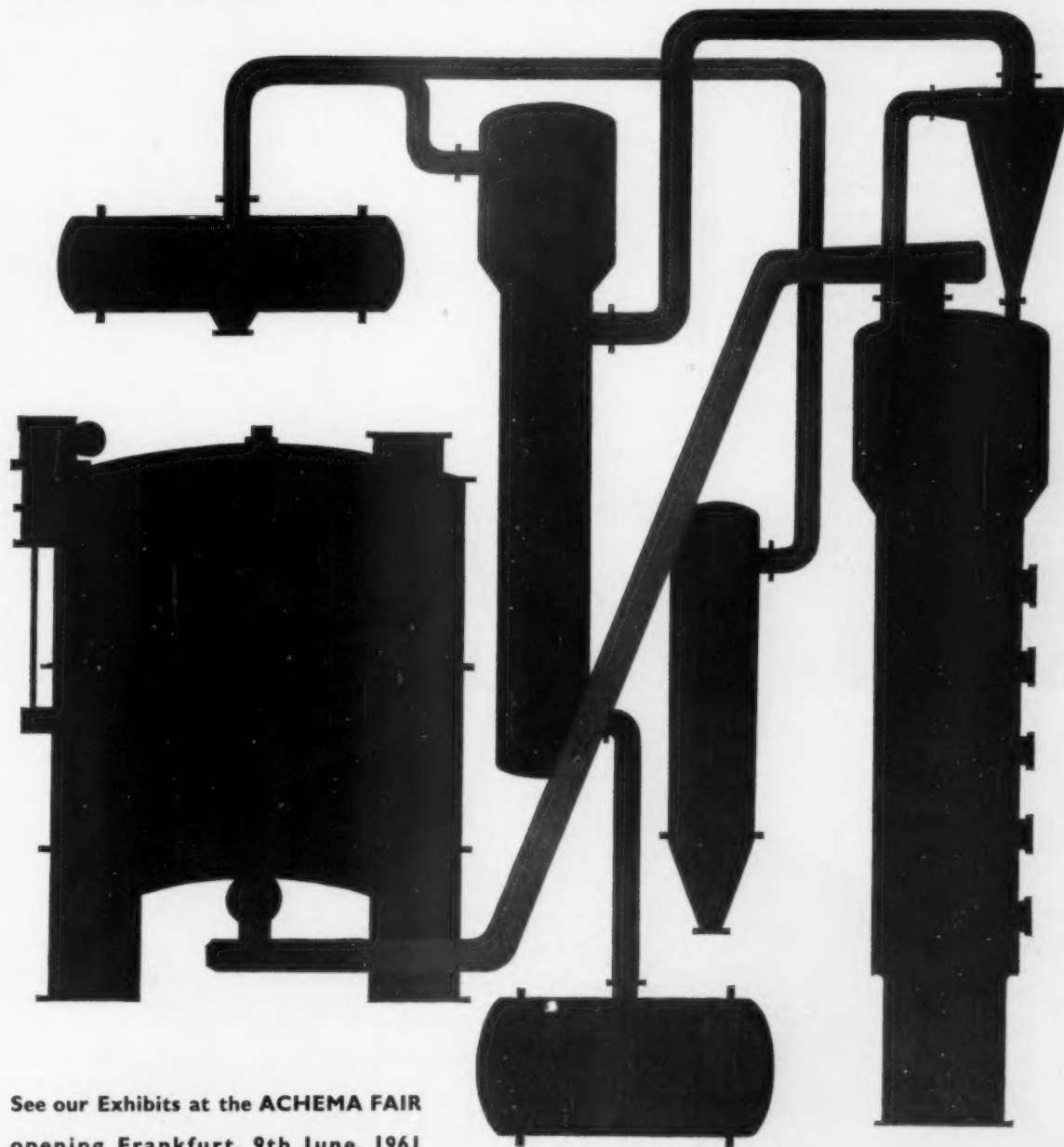
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M.C.

ILLUSTRATED: A stainless mixing vessel with special turbine head, designed for electric jacket heating (not shown). Part of a complete process plant designed, manufactured and installed at Autoclean Ltd., London factory.

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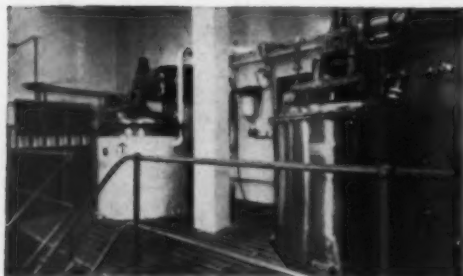
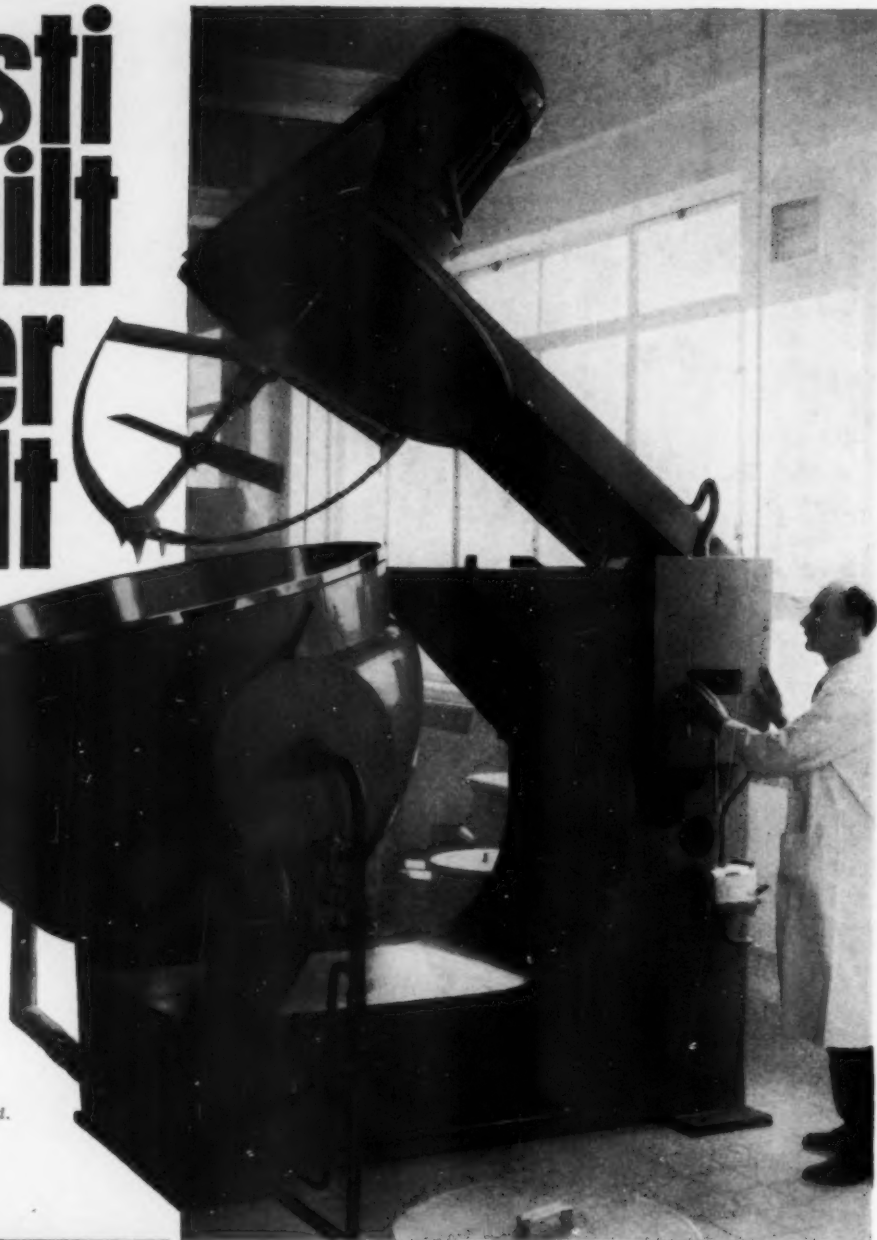
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Manufacturing Chemist—May, 1961

A61

Giusti built better built

*A 200 gallon steam-jacketed
pan with 4 speed counter-
rotating agitator.
Photo by kind permission
of Helena Rubinstein Limited.*



*Manufacturing Chemists' Process Plant.
Photo by kind permission of John Wyeth & Brother Limited.*

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Belle Isle Works 210-212 York Way Kings Cross London N7
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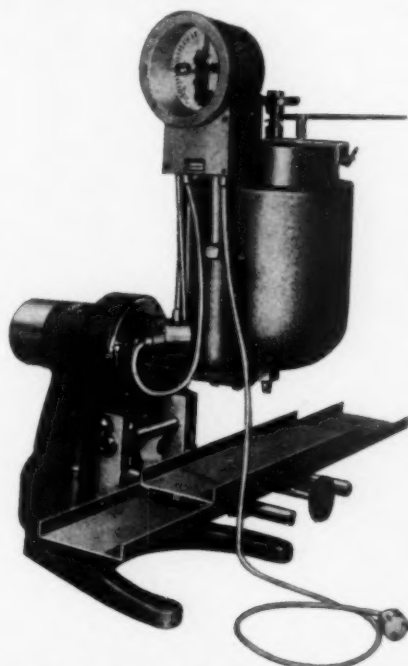
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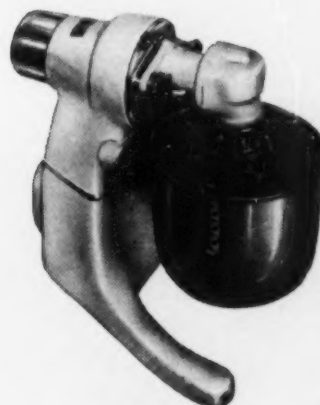
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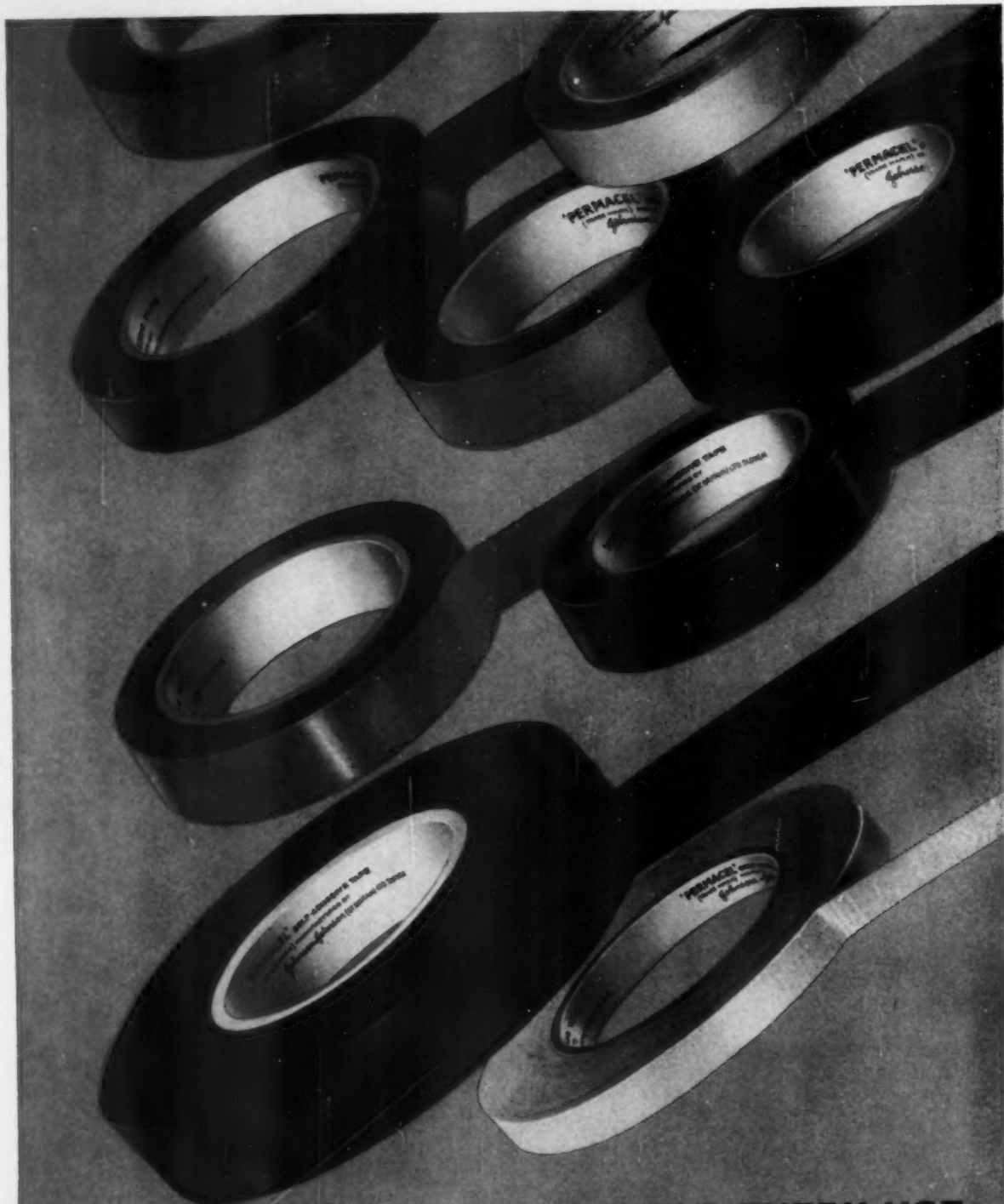
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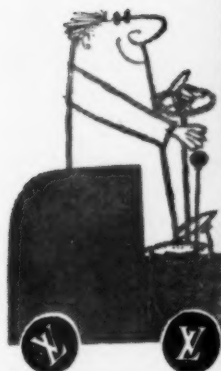
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Manufacturing Chemist

Editor: W. G. Norris

Vol. XXXII, No. 5

MAY, 1961

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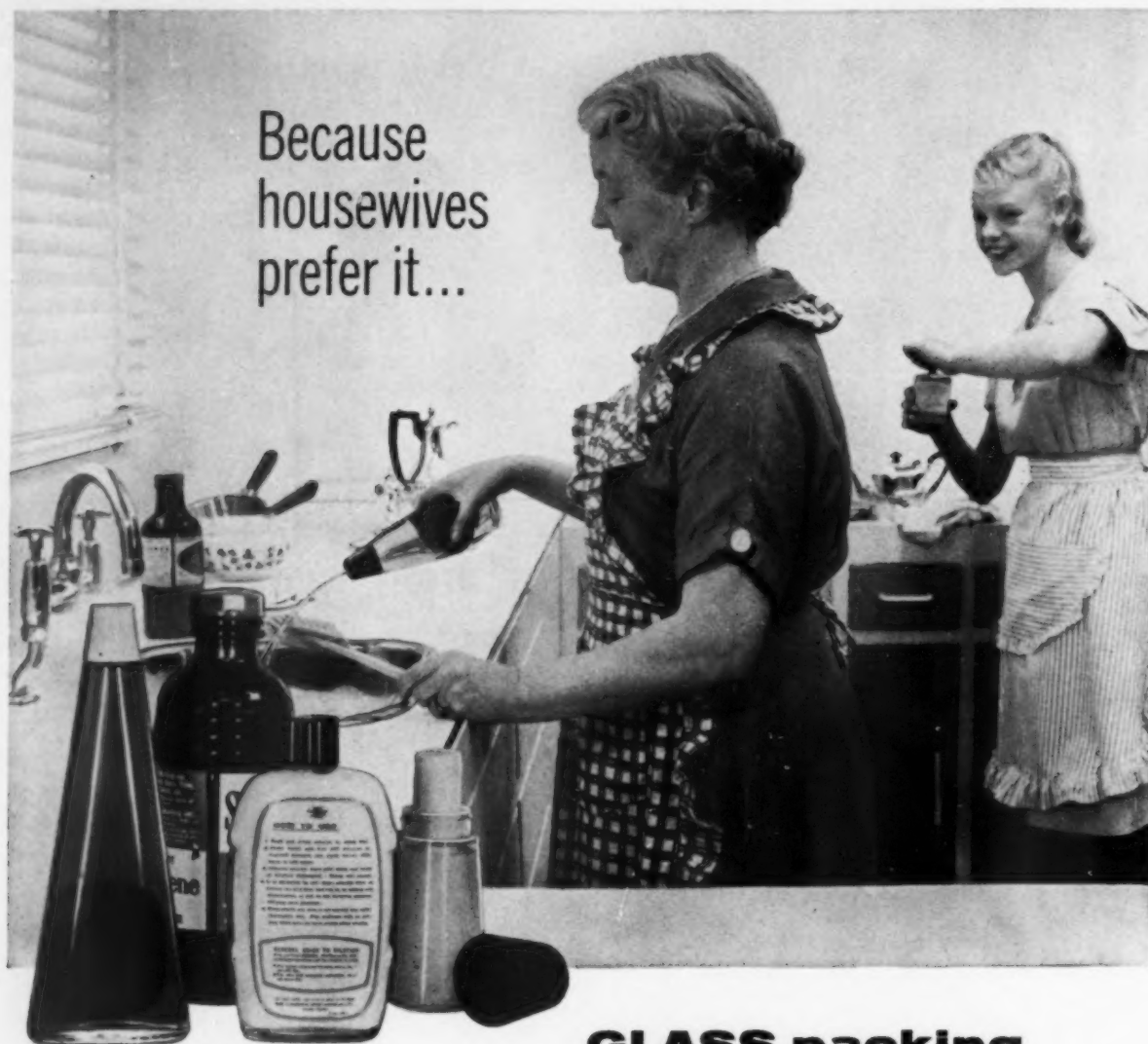
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A Publication of the Leonard Hill Technical Group:
Leonard Hill House, Eden Street, London, N.W.1 (Euston 5911)

Cables:—Abroad: Lenardil London. Inland: Lenardil Norwest London.

U.S.A.: 1214 Villa Drive, N.E. Atlanta, Georgia; 2515 Beverly Blvd., Los Angeles 57, Calif. (Dunkirk 1-2241); 121 Ward Parkway, Kansas City, 12, Mo.; 501 Fifth Avenue, Room 611, New York 17, N.Y. (YUkon 6-2477); 681 Market Street, San Francisco 5, California (EXbrook 2-2612); 332 West Harrison St., Oak Park, Illinois (COLUMbus 1-7906); 1501 Euclid Bldg., Room 426, Cleveland 15, Ohio (TOWER 1-2280); ITALY: Via Filippo Turati 3 (Palazzo Giardino), Milan; SWEDEN: Tunnelgate 19B, Stockholm; DENMARK: Palaegade 7, 3 Sal., Copenhagen K.

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May, 1961—Manufacturing Chemist

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This year's total of £8 million is the lowest of the three years, but this is not surprising; obviously many of the projects reported last year, which together made a record total of £12 million, satisfy the immediate expansion programmes of many firms and indeed are still under construction.

An average capital investment of over £9.5 million p.a. is convincing evidence of the vigour and progressiveness of the pharmaceutical manufacturing industry. It compares with an average annual capital investment for the chemical and allied industries of £149 million in the three years to 1959.

The three surveys show that the American subsidiaries and affiliates are setting the pace in expansion, but the major British companies like Wellcome, I.C.I., Glaxo, Boots and Beecham have not been slothful. I.C.I.'s Macclesfield project, which will cost £4 million, is the overwhelmingly largest project we have reported in the last three years and it is doubtful if it will be matched for some time. But the smaller fry are also investing proportionately substantial sums and the general picture is one of optimism and determination to provide the country with the best possible drugs and medicines, while simultaneously reinforcing the already strong export potential of the industry. It must also be remembered that many firms are spending heavily on overseas subsidiaries and affiliates; these figures are not included in our survey, which is confined to the United Kingdom.

Prescription not filled

THE much discussed *Prescribers' Journal* has now appeared. The first issue has not raised much enthusiasm. The medical correspondent of *The Times* said it contained no information that has not already been available to doctors for a considerable time. The subjects of the three articles are Griseofulvin, Corticosteroid Therapy in Skin Maladies, and Penicillins. The articles are clear and independent

but do they, in fact, say anything new, or sufficiently new to justify the cost of the new journal?

The Times also criticised the fact that the journal is not independent or at least not as independent as the Hinchliffe Committee wanted it to be. They said that *Prescribers' Notes*, issued by the Ministry of Health should be replaced by an independent journal run by the medical profession for the profession. In fact the address of the editor is Chesham House, Regent Street, London, which houses Ministry of Health staff, and the committee of management contains professional advisers of the Ministry. Furthermore the contents are Crown Copyright, hardly an imprint of independence. *The Lancet*, though rather more welcoming than *The Times*, also questions the independence of the journal.

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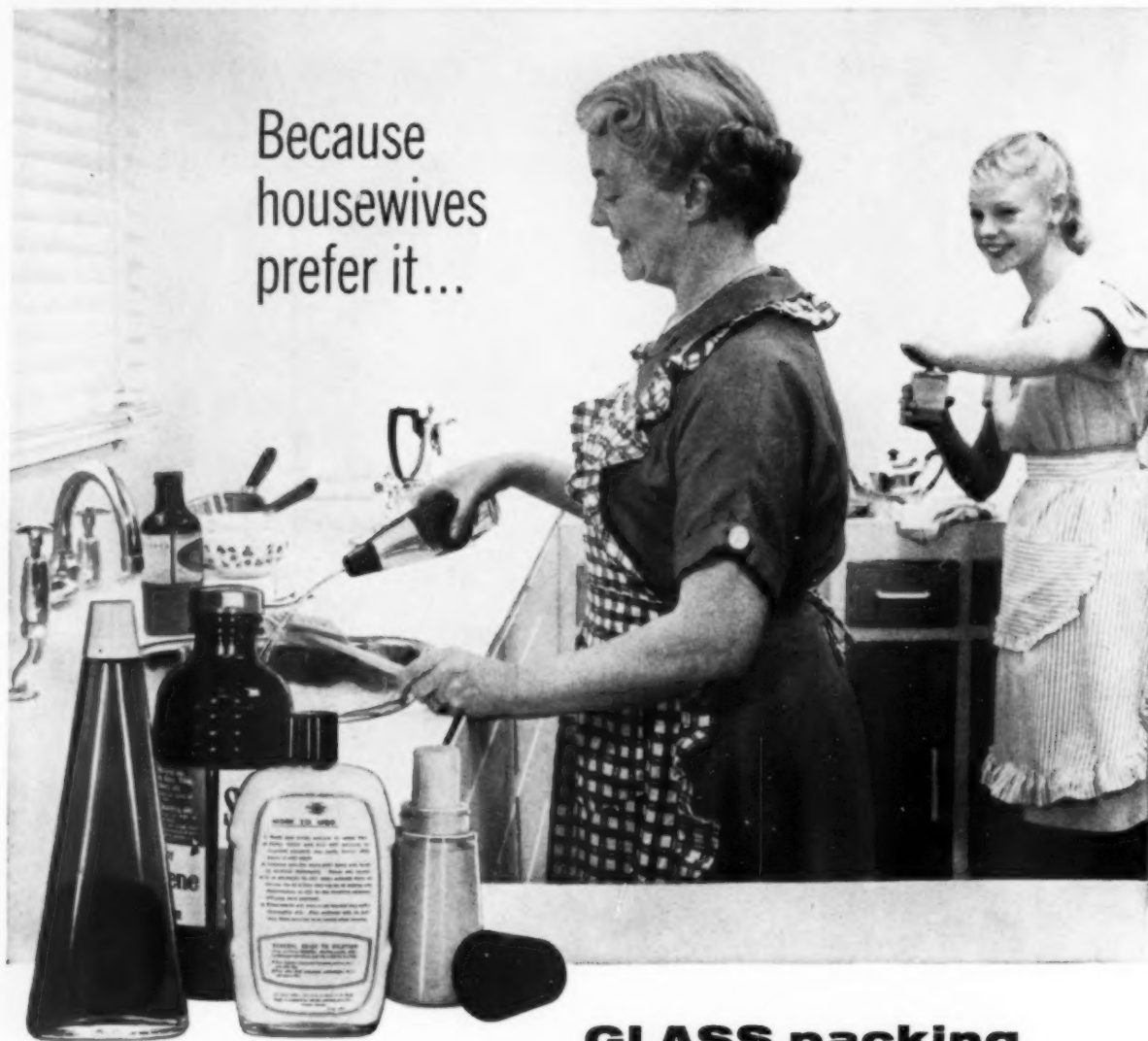
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THAT we in Britain have a lot to learn about really up-to-date methods of sterilisation was made plain last month during the Symposium on the Sterilisation of Surgical Materials held in London. It was significant, for example, that the papers on ethylene oxide sterilisation were contributed by overseas delegates. Although the Wantage Irradiation laboratory has done notable work on sterilisation with ionising radiation, here again Britain appears to be lagging.

The Symposium was the biggest of its kind to be held in this country, and that it was held at all was almost entirely due to the vision and energy of one firm, Smith and Nephew Research Ltd., with the backing of its large parent company. The President of the Pharmaceutical Society, partners in the enterprise, described the Symposium as "the biggest piece of commercial broadmindedness I have known." Mr. Reid continued: "To share knowledge with competitors is both generous and humane."

The symposium attracted delegates from the medical and pharmaceutical professions and from industry. This cross-fertilisation of ideas between professional people and industry was enormously valuable. It is evident that the medical profession is realising more and more how dependent it is upon industry to make practical the advances in research and technique for the common good. It was also good to see a professional society collaborating

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wholeheartedly with a commercial firm. Mr. D. E. Seymour, managing director of Smith and Nephew Research Ltd., thanked the Pharmaceutical Society for its support and hoped that other societies and other companies would follow an excellent example. We entirely agree. Too many professional and learned societies have an outdated "holier-than-thou" attitude towards industry and commerce. Of course there are difficulties in collaboration of this kind and of course there will be critics and denigrators. But we really cannot afford to stick to old-fashioned conceptions of professional etiquette in the increasingly demanding and competitive times that we live in. We need big people with big ideas . . . co-operation not mistrust.

The truth about fertiliser subsidies

IN THE joint ECE/FAO report on 1959-60 prices of agricultural products and fertilisers in Europe it is said that "the largest amount of total subsidies in all OEEC countries are granted to farmers in the United Kingdom for their purchases of fertilisers." But this year, as from July 1, the rates of subsidies on fertiliser purchases by British farmers are to be reduced. The truth is that the subsidy scheme here has been so highly successful that its cost to the country must be kept within an acceptable amount. Subsidies cost £32,200,000 last year and the year before £29,400,000. Even now the reduction proposed in the 1961 Farm Review is aimed at a cut of only about £2,500,000; if fertiliser use continues to expand, the total subsidy cost could still appreciably exceed £30 million.

As the annual farming bill for fertilisers is about £115,000,000 the subsidy is at least 25%. It applies in fact only to nitrogen and phosphate, so that on these classes of fertiliser the percentage rate is higher, usually over 40% of cost. One reason that the Government can reduce subsidy aid for fertiliser purchases is that the prices of most fertilisers were reduced last year. This might seem a little hard on the industry, which might well hope that lowered prices would lead to larger orders, but few manufacturers are likely to look at the subsidy cuts in this way. In the long run, high subsidies for fertilisers must be regarded with misgivings. Ideally, the annual trade in fertilisers would be more solidly established if it were free from subsidies. But the hard truth is that price support payments and subsidies on farming costs are the inevitable consequence of the British policy to maintain a food market that is predominantly free and open to all. If instead farmers enjoyed tariff protection—as do other industries, e.g. cars, cameras, etc.—there would be no need for an annual bill of some £270 million for price support and production subsidies. But those who believe food to be dear in this country would then quickly find how much dearer it can be!

Scientists outside agriculture may reason that if fertilisers bring the higher yields they claim to produce, surely even at full cost investment in fertilisers

pays? This is true on many farms where production is highly efficient. But the subsidies were required as incentives to make many more farmers increase the productive efficiency of their farms. Fertilisers are still seriously under-used on much of our grassland and on arable crops in many areas. The subsidy on fertiliser purchases is in fact classed as a "production grant"—"efficiency grant" might perhaps have been a better term.

It should be made clear that it is *not* the production of fertilisers that is subsidised—it is the farmer's ability to buy them that is supported. This is even the *modus operandi* of administering the subsidies—the farmer claims them after he has been invoiced at real prices. Recently it has been argued in the Commons that it would be less cumbersome to subsidise the fertilisers at source, i.e. with direct subsidies to manufacturers. It is to be hoped this will never be done. If it was, it would not be long before the industry was being unfairly attacked for needing subsidies as well as some degree of tariff protection.

Millions for medical research

ALTHOUGH it is 25 years since the Wellcome Trust was established it is only during the past five that it has been able to make grants on a scale approaching the intention of its founder. The value of the grants made in 1959-60 was more than 30 times greater than in 1954-55 and almost all the total disbursements to date, amounting to over £3 million, have been made in the last five years. The reason is simply that the first 20 years covered the war and post-war period during which economic conditions reduced the Trust's income which, of course, is derived entirely from the distributable profits of the Wellcome Foundation and its American and other overseas companies. In the last two years the Trust made grants totalling £1.2 million and in the next two it expects to give away £1.6 million. The grants are made with no strings attached. The recipients are free to spend the money as they choose on human and animal medical research.

Roughly one-half of the grants made in 1958-60 is being used to provide better laboratories for workers with important long-term research programmes and over £400,000 is being spent on other research objects and on medical libraries and museums.

The Trust is exceptional among U.K. charities in having a completely international mandate. Hence, although most of the grants to date have been made to U.K. recipients, some large grants have been made to Commonwealth and United States recipients. Giving money to such a rich country as the United States may seem quixotic, but it must be remembered that much of the profits of the Wellcome Foundation come from its U.S. company.

Within a few years the Trust may be making grants at a rate of £1 million a year, a very handsome sum by the standards by which medical research is financed in this country. Government support of this

vital research is niggardly. The Medical Research Council does wonders on about £4 million a year. The University Grants Committee has only £40 million a year for all forms of university research, so there is little available for medicine. If it were not for the benefactions of private bodies like the Trust our medical scientists would be even worse off than they are.

While the Trust is the outstanding example of pharmaceutical industry profits being used for humane research, other pharmaceutical companies also make notable contributions. Unfortunately this practical charity attracts less publicity than criticism of drug profits.

Better soils through chemicals

WHILE PROGRESS is measured in sputniks and satellites launched, cars per family and the rate our lives become automated, not enough attention is focused on the problem of food production and the world's increasing population. There are now 2,500 million people on this earth and in 50 years there may be 5,000 million. The earth must be made to yield the food for this enormous population and one answer to this problem is the preservation and reclamation, mechanically and chemically, of all the productive and waste land in the world. Asphalt and sodium alginate have both been investigated, the former for soil erosion and the latter for soil conditioning.

Esso Research and Engineering Co. in U.S.A. has experimented with asphalt film to stimulate grass growth and alleviate dust-bowl conditions. Soil moisture losses have been reduced by covering seed beds with asphalt film. The film is formulated to last the five or six weeks required for seed germination and breakthrough. Another experiment involves the conservation of rainfall in arid areas. Alternate strips of dry land are covered with thin coatings of asphalt. Rain runs off the waterproofed strips and is diverted to land under cultivation.

Alginure has been produced from seaweed by a process developed by Oxford Horticultural Laboratories Ltd. It contains sodium alginate together with other carbohydrate material. The manufacturers claim that *Alginure* is an economical soil conditioner. Sodium alginate itself is a natural poly-electrolyte consisting of a polymeric acid of high molecular weight which can be neutralised by any base, e.g. those of the metals and ammonia. With light sandy soil *Alginure* forms a jelly which gums the particles together; with clay soils the main action is that of flocculation and even when heavily watered the soil does not re-form into clay.

The vast, unproductive desert areas in the Middle East and Far East must somehow be turned into useful agricultural land to meet the needs of the people in these regions. The scope in this field is very broad and it offers still further agricultural opportunities to the chemical industry.

What biochemists could do for the drug industry

ALTHOUGH the Biochemical Society was founded 50 years ago the biochemist has not made a great impact on industry. Perhaps this is because industry does not have a clear idea of what a biochemist does. Even biochemists find it difficult to define themselves. Prof. A. Neuberger of St. Mary's Hospital Medical School says: "Having considered myself a biochemist for all my working life, I still do not find it easy to arrive at a satisfactory definition. Probably the most reasonable definition of a biochemist is a man who brings chemical techniques to bear on biological problems."

Dr. F. A. Robinson, director of research of Allen and Hanburys, believes that the pharmaceutical industry is the biggest employer of biochemists. Writing in a booklet on the organisation of research in biochemistry published by the Biochemical Society, he estimates that of the 1,000 graduates employed by the industry about one-third do biological research and one-sixth biochemical research and development. This gives a total of about 150 biochemists who cost the industry between £500,000 and £600,000 a year. This is not an impressive sum and this is probably because the biochemist is not a key figure in the same way as the bacteriologist and microbiologist. Perhaps it is because there is no definite biochemical industry, though antibiotics come pretty close to it.

Biochemists would enormously increase their importance if they could find a more logical method of developing new drugs than the present one of trial and error. Dr. Robinson thinks the day may come when sufficient is known about the enzymes in bacteria and in the host to enable biochemists to define the type of compound that will selectively interfere with the life processes of bacteria without harming the host.

Meanwhile the universities might do more work on predicting the structure of useful compounds. It is all very well to have a biochemical explanation of how a new drug works, but businessmen prefer to be told where to put their money rather than what a good investment they made five years previously.

New market for detergents

It is sometimes said that a country's social progress can be judged by the amount of soap its people use. It is significant then that Nepal, the tiny State famous for its possession of Mount Everest, imported in 1959 28 million dollars' worth of soaps, detergents and perfumes. This is a remarkable total for a country of 8½ million people which, until 1950, was practically isolated from the rest of the world. Ten years ago there was a revolution and the king reorganised the government, including among his ministers and advisers men educated in the West. Since then there has been considerable progress, the increased consumption of soaps and detergents merely being one manifestation of this progress.

In Katmandu a small essential oils industry has been in operation for some time.

Four-fifths of the country's imports are brought by air. The Katmandu airport was built and is operated by British technicians and British planes operate a daily service. Despite this, there has been no preference given to British imports. One-fifth of the soap and detergent products comes from Western Europe. The country's aim is to distribute its interest among the smaller European countries which are believed to have no colonial ambitions. European exporters of detergents have largely ignored this expanding though yet small market. The Nepal International Trade Fair in 1960 attracted little attention. Its aim was to advertise the country's import needs and to suggest to its inhabitants which products could be manufactured indigenously. Ten import firms have collectively established a fund of 250 million dollars, mainly to establish confidence internationally.

New ideas from the Treasury

FOR years successive Chancellors of the Exchequer have been grumbled at for being too orthodox in drafting their Budgets. Mr. Selwyn Lloyd has now produced a Budget with several novel ideas. The raising of the starting level of surtax to £5,000 a year—long overdue—is neatly balanced by an increase in profits tax of 2½%. The duty on fuel oils is raised by 2d. a gal. and vehicle licences will cost £15 a year instead of £12 10s.; both imposts will increase manufacturers' costs.

The most controversial innovations are the new economic regulators (controls have unpleasant associations, hence the new word, which means the same thing). Mr. Lloyd wants powers to vary duties and purchase tax by 10% up or down, according to the state of the economy and without the need to introduce a Budget. This is intended to be a flexible and sensitive means of controlling demand. In fact it cannot be as swift-acting as some people suppose and it will certainly give manufacturers and traders a great deal of trouble and uncertainty. Slow moving goods like expensive cosmetics will be even more hazardous propositions for the retailer than they are now.

The other new regulator is a payroll tax of 4s. a week per employee. This proposal has been badly received and even the Chancellor now seems a bit uncertain about it. The chemical industry, traditionally a big user of equipment, would not feel the tax as much as less mechanised industries but it must certainly now be reckoned with as a possible additional cost when fixing prices. The idea of the tax is to deter firms from keeping men on short time during local slumps in order to stimulate their transfer to firms short of labour. While the need for mobility of labour is obvious the proposed payroll tax seems a clumsy, blunderbuss device that could seriously hit hospitals, shops, public authorities and other employers who cannot easily replace men with machines.

Abstract—and concrete

RECENTLY one of our chemical societies appealed for abstractors, particularly for papers in German, Russian, Czech and Polish. The appeal said that the preparation of abstracts was to be regarded as "a service to the chemical profession," although "some payment is made to abstractors." The last thing we would want to do is to embarrass any scientific society or discourage professional men from labours of love. But surely it is partly a degradation of any profession, albeit done by itself to itself, to expect skilled services to be rendered regularly for a token reward far below a proper rate of remuneration? The chemical profession has made great economic advances since the late 1930s. The badly underpaid chemist is a rarity now, and the few who are have plenty of opportunities to do better elsewhere. Yet abstracting is still regarded as a lowly-paid chore, the skilled hack-work that many underpaid chemists in years gone by were glad to do in their spare hours. Granted, this outlook is perpetuated only because the publication and distribution of abstracts is an expensive and unprofitable operation that falls upon the societies. That this should be so in a country whose survival depends upon science—and one that now has a Minister of Science!—is a folly of our age and one among many concerned with science that future generations will condemn. If it must by circumstances still exist, let some voices also condemn it *now*.

The preparation of a useful abstract is a task to be valued almost inversely with the abstract's length. It calls for special knowledge of one or another field of science. When it also calls for knowledge of any of the less universally read languages, the task is obviously one of high and relatively uncommon ability. Yet it is less well rewarded than small town newspaper reporting.

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"Manufacturing Chemist's" Third Annual Survey of

Expansion in the British Pharmaceutical Industry

Twenty-nine Firms Plan to Spend £8 million

MANUFACTURING CHEMIST's Third Annual Survey reveals an expenditure on recent or new projects of £8,064,918. Twenty-nine firms reported expansion, compared with 31 last year and 21 in 1959. It was not to be expected that the record £12 million reported last year would be approached this year, since many of the projects started in 1960 are still in the construction stage. Even so, this year's total is not far below the £8.6 million reported in 1959.

In this year's survey appear 11 firms who have not previously appeared. The three surveys, therefore, account for 53 firms and a total expenditure of £28,690,000. It is emphasised that only expansion projects in the United Kingdom are reported; many firms

are also spending considerable sums abroad, but this is not within our scope.

American subsidiaries and affiliates are again very much in evidence and would dominate the picture were it not for the £4 million project of I.C.I.'s Pharmaceutical Division.

Two firms did not give costs, so the final total is higher than that given. One firm gave a figure for inclusion in the global total only. Certain projects reported last year are reported again this year and the reasons for this are given. In each case the costs have been excluded from this year's total.

We thank all the firms whose co-operation has made this survey possible.

Firm	Projects	Purpose of new facilities	Costs	Main contractors and suppliers
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ALLEN AND HANBURY LTD., Ware, Herts.	Conversion of buildings. One for completion May 1961. Extension of existing buildings. Due for completion April 1962. Plant re-equipment. Due for completion July 1961.	Pharmaceutical research. Pharmacological research. Manufacture of infusion fluids.	Buildings, £20,000. Buildings, £25,000. Plant, £15,000.	Local builders. — Mascarini (Mason and Morton Ltd.), Radio Heaters Ltd. A. and H. Sterilizer Division.
ASTRA-HEWLETT LTD., Watford, Herts.	Reconstruction of premises to provide new laboratories with a floor area of approximately 3,000 sq. ft. Completed in 1960.	Production of Xylocaine.	Buildings, £17,000. Plant and machinery £16,500.	—
BEECHAM RESEARCH LABORATORIES LTD., Worthing, Sussex.	New factory.	Manufacture of antibiotics and fine chemicals.	£2,000,000. (This sum was included in last year's total and is therefore excluded from this year's. It is given here again because last year it was not separately itemised.)	—

In Katmandu a small essential oils industry has been in operation for some time.

Four-fifths of the country's imports are brought by air. The Katmandu airport was built and is operated by British technicians and British planes operate a daily service. Despite this, there has been no preference given to British imports. One-fifth of the soap and detergent products comes from Western Europe. The country's aim is to distribute its interest among the smaller European countries which are believed to have no colonial ambitions. European exporters of detergents have largely ignored this expanding though yet small market. The Nepal International Trade Fair in 1960 attracted little attention. Its aim was to advertise the country's import needs and to suggest to its inhabitants which products could be manufactured indigenously. Ten import firms have collectively established a fund of 250 million dollars, mainly to establish confidence internationally.

New ideas from the Treasury

FOR years successive Chancellors of the Exchequer have been grumbled at for being too orthodox in drafting their Budgets. Mr. Selwyn Lloyd has now produced a Budget with several novel ideas. The raising of the starting level of surtax to £5,000 a year—long overdue—is neatly balanced by an increase in profits tax of 2½%. The duty on fuel oils is raised by 2d. a gal. and vehicle licences will cost £15 a year instead of £12 10s.; both imposts will increase manufacturers' costs.

The most controversial innovations are the new economic regulators (controls have unpleasant associations, hence the new word, which means the same thing). Mr. Lloyd wants powers to vary duties and purchase tax by 10% up or down, according to the state of the economy and without the need to introduce a Budget. This is intended to be a flexible and sensitive means of controlling demand. In fact it cannot be as swift-acting as some people suppose and it will certainly give manufacturers and traders a great deal of trouble and uncertainty. Slow moving goods like expensive cosmetics will be even more hazardous propositions for the retailer than they are now.

The other new regulator is a payroll tax of 4s. a week per employee. This proposal has been badly received and even the Chancellor now seems a bit uncertain about it. The chemical industry, traditionally a big user of equipment, would not feel the tax as much as less mechanised industries but it must certainly now be reckoned with as a possible additional cost when fixing prices. The idea of the tax is to deter firms from keeping men on short time during local slumps in order to stimulate their transfer to firms short of labour. While the need for mobility of labour is obvious the proposed payroll tax seems a clumsy, blunderbuss device that could seriously hit hospitals, shops, public authorities and other employers who cannot easily replace men with machines.

Abstract—and concrete

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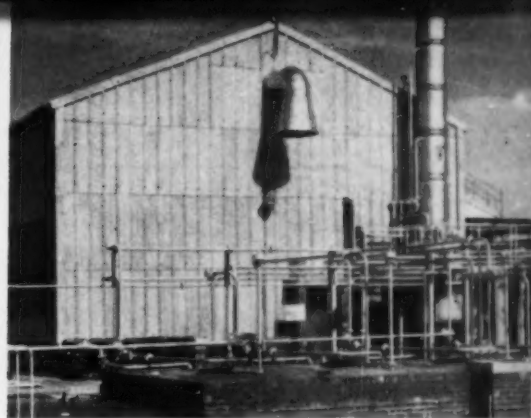
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ALLEN AND HANBURY LTD., Ware, Herts.	Conversion of buildings. One for completion May 1961.	Pharmaceutical research.	Buildings, £20,000.	Local builders.
	Extension of existing buildings. Due for completion April 1962.	Pharmacological research.	Buildings, £25,000.	—
	Plant re-equipment. Due for completion July 1961.	Manufacture of infusion fluids.	Plant, £15,000.	Mascarini (Mason and Morton Ltd.), Radio Heaters Ltd. A. and H. Sterilizer Division.
ASTRA-HEWLETT LTD., Watford, Herts.	Reconstruction of premises to provide new laboratories with a floor area of approximately 3,000 sq. ft. Completed in 1960.	Production of Xylocaine.	Buildings, £17,000. Plant and machinery £16,500.	—
BEECHAM RESEARCH LABORATORIES LTD., Worthing, Sussex.	New factory.	Manufacture of antibiotics and fine chemicals.	£2,000,000. (This sum was included in last year's total and is therefore excluded from this year's. It is given here again because last year it was not separately itemised.)	—

EXPANSION IN THE PHARMACEUTICAL INDUSTRY "M.C.'S" 1961 SURVEY

Firm	Projects	Purpose of new facilities	Costs	Main contractors and suppliers
BRADLEY AND BLISS LTD., Waddon Marsh Way, Croydon, Surrey.	Offices and warehouse. Completed January 1961. Approx. 13,000 sq. ft.	Wholesale distribution of pharmaceutical proprietary and photographic products.	£50,000.	A. C. Whyte (Croydon) Ltd.
King's Road, Reading, Berks.	Further extension to factory, warehouse and office accommodation.	Required to keep up with expanding distribution.	—	—
BRITISH DRUG HOUSES LTD., B.D.H. Laboratory Chemicals Division, Poole, Dorset.	Further development of 18-acre site at Broom Road, Poole.	Warehousing, packing and despatch of laboratory chemicals and fine chemicals.	£600,000 spread over 2 to 3 years. (This sum was included in last year's total and is therefore excluded from this year's. It is republished to round out the picture of current B.D.H. expansion.)	John Laing and Son Ltd.
Godalming, Surrey.	Extension to biological laboratories.	Increased animal testing facilities.	£34,000 on building. £6,000 on equipment.	—
CYANAMID OF GREAT BRITAIN LTD., Gosport, Hants.	Pharmacological laboratories. Due for completion by end of 1961.	Pharmacological control of manufactured drugs, and experimental work on new formulations.	£50,000.	—
DALMAS LTD., Lutterworth.	Building completed April 1961.	Manufacture of medical and surgical plasters and cloth adhesive tapes.	Buildings, £8,000. Boiler and new plant, £100,000.	—
Chorley, Lancs.	Conversion of 45,000 sq. ft. mill. In partial production. Full production expected by June.	Manufacture of plastic plasters and tapes.	Plant, £100,000. (These sums were included in last year's total and have been excluded from this year's. They are more precise than the approximations given previously.)	—
DUNCAN FLOCKHART, Research Laboratories, Edinburgh.	Extensions to biological laboratories.	—	—	James Turner and Co. Ltd., Edinburgh.
GLAXO LABORATORIES LTD., Ulverston, Lancs.	New plant. Began operations in August 1960.	Vitamin A production.	£40,000.	Taylor Woodrow Ltd.
IMPERIAL CHEMICAL INDUSTRIES LTD., Pharmaceuticals Division, Huddersfield, Macclesfield, Cheshire.	Construction of new factory. Due for completion in 1964.	Integration and expansion of facilities for manufacture, processing and warehousing of pharmaceutical products. Output worth several million pounds a year.	About £4,000,000.	—
MAY AND BAKER LTD., Dagenham, Norwich.	New office block.	Administration.	Buildings, £75,000.	W. and C. French Ltd.
	Three new factory buildings.	Increased production of pharmaceutical, veterinary and agricultural chemicals.	Buildings, £120,000.	R. G. Carter Ltd. Beaves (Structures) Ltd.
MERCK SHARP AND DOHME LTD., Hoddesdon, Herts.	New buildings and extensions. Due for completion late 1961.	Canteen and welfare services. Production.	Buildings, £25,000. Plant, £15,000.	—
MONSANTO CHEMICALS LTD., Ruabon, North Wales.	Rebuilding of plant.	Improved and enlarged production of phenacetin.	—	Monsanto Chemicals Engineering Dept.



Pfizer's factory at Sandwich, Kent, which has been extensively developed in the past few years. New buildings recorded in this year's survey are an animal unit and pharmacological laboratories costing nearly £137,000. Right: Glaxo's new vitamin A plant at Ulverston, Lancs, completed at a cost of £40,000.

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THOMAS MORSON AND SON LTD., Ponders End, Middx.	New building and new boiler installation. Due for completion at the end of 1961 and in 1962.	Extension of general organics unit and increase in glycerophosphates production and solvent recovery facilities.	£120,000.	G.W.B. Furnaces. Paterson Engineering Co. Enamelled Metal Products. Q.V.F. Ltd. Elliott Bros. John Dore Ltd.
OPTREX LTD., Perivale, Greenford, Middx.	New building.	Production of new black-currant health drink <i>Fru-vita</i> and increased production of <i>Optrose</i> rose hip syrup.	Buildings, £2,000. Plant, £17,000.	Building: J. M. Hill, Wembley, Middx. Plant: Mixing and storage tanks—James Day and Enamelled Metal Prods. Corpn. Steam pans—James Day and C.P. Equipment. Filters—Farrow and Jackson. Filter press—Hirsch. Pumps—C.P. Equipment. Washing Machines—Dawson, Miller Hydro. Filling Machines—Gravfil, Albro. Conveyor systems—Gravfil. Disintegrator—Scott Reitz. Vacuum still—C.P. Equipment.
PAINES AND BYRNE LTD., Perivale, Greenford, Middx.	New processing plant.	Manufacture of steroid hormones.	£15,000.	—
PARKE, DAVIS AND CO., Hounslow, Middx.	New building for pilot plant processes. Now in operation.	Product development.	—	—
	Expansion, reorganisation and modernisation of production laboratories 1961-64.	To improve and expand production.	—	—
	Extension and modernisation of power plant. Total area 6,000 sq. ft.	To meet increasing power demands of production departments.	—	Fassnidge Son and Norris Ltd.
Crewe, Cheshire.	Two-storey office block and single-storey warehouse with total floor area of 11,062 sq. ft. (building completed February 1961).	To enhance distribution of medical products to the north of England.	—	Precast Utilities (London) Ltd.
PFIZER LTD., Sandwich.	Animal isolation unit. Completed March 1961.	Microbiological research.	Buildings, £23,085. Plant and equipment, £23,625.	C. Jenner and Son Ltd.
	Pharmacology facilities. Due for completion June 1961.	Pharmacological research.	Buildings, £59,677. Plant and equipment, £30,470.	
Kemball Bishop subsidiary, Bromley-by-Bow.	Expansion of citric acid production. Completed March 1961.	Calcium citrate production (approximately 3,000 tons p.a.).	Buildings, £8,236. Plant and equipment, £61,325.	

EXPANSION IN THE PHARMACEUTICAL INDUSTRY "M.C.'S" 1961 SURVEY

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RIKER LABORATORIES LTD., Loughborough.	Analytical and development laboratories. Completed March 1961.	Production quality control. Development of new and improved ethical specialities.	Buildings, £9,250. Equipment, £750.	Local building and services contractors. Furniture by Armstrongs of Hull and Griffin and George.
	New storage and warehouse building. First stage 15,000 sq. ft., due for completion end 1961.	Packing material storage and packing for distribution of finished product.	Buildings, including services, £20,000.	—
	New cordless automatic PABX4 telephone exchange.	To serve head office and laboratory building.	Equipment, £4,500.	Reliance Telephone Co.
G. D. SEARLE AND CO. LTD., High Wycombe, Bucks.	Extension of existing premises. Mid-1962.	Additional offices, warehouse and manufacturing facilities.	About £100,000.	—
SMITH KLINE AND FRENCH LABORATORIES LTD., Welwyn Garden City, Herts.	Extension. Completion late 1962.	Warehouse and office.	£550,000.	William Sindall Ltd.
STAFFORD ALLEN AND SONS LTD., Long Melford, Sudbury, Suffolk.	Three new buildings for completion 1961-62.	Pharmaceutical manufacturing, essential oil distillation and aromatic chemical production.	Buildings, £100,000. Equipment, £25,000.	—
THOMPSON AND CAPPER LTD., Speke Hall Road, Liverpool 24.	Complete new office and administration building with extensions to factory. Completed March 1961.	The new office building and works extensions will together make available approx. 75,000 sq. ft. of manufacturing area urgently needed.	Buildings, approx. £30,000. Plant, etc., £10,000. (Of these sums, all but £5,000 was given last year and is thus excluded from this year's total.)	Worthingtons (Contractors) Ltd.
THORNTON AND ROSS LTD., Linthwaite, Huddersfield.	Extension of 11,400 sq. ft. Completed December 1960.	To improve layout of manufacture and storage.	Buildings, £25,000. Plant and machinery, £22,500.	Albro Fillers. Bottle washing—Dawson Bros. Fork-lift truck—Jewsbury Ltd.
UPJOHN LTD., Crawley, Sussex.	Extension to buildings. Completion mid-1962.	Pharmaceutical production area, control laboratories, additional office and storage space.	Buildings, £450,000. Plant and equipment, £250,000.	G. H. Buckle and Partners, mechanical and electrical engineers.
WARD, BLENKINSOP AND CO. LTD., Halebank, Liverpool.	New laboratories.	Development and research.	Building and equipment £20,000. (Included last year and excluded from this year's total.)	—
	New manufacturing area.	Fine chemical manufacture.	Building, £20,000. Plant, £50,000.	—
Wembley, Middlesex.	Research laboratories.	Pure research.	Building and equipment, £10,000.	—
WELLCOME FOUNDATION LTD., Beckenham, Kent.	Immunological building.	Research, development and production of antisera for human and veterinary use.	£500,000. (Included last year and excluded from this year's total.)	Taylor Woodrow Construction Ltd.
	Pharmacology laboratory.	—	£300,000. (£250,000 estimated last year, therefore excluded from this year's total.)	Ditto
Dartford, Kent.	Packed stock building.	—	£200,000.	John Mowlem and Co. Ltd.
	Major extension to analytical control laboratories.	—	£100,000.	Trollope and Colls Ltd.
	Alterations to buildings and plant installation.	Improved chemical manufacturing facilities.	£100,000.	—
JOHN WYETH AND BROTHER LTD., Havant, Hants.	Chronic and sub-acute toxicity unit. Due for completion May 1961.	Pharmacological research.	Building and services, £26,000. Equipment, £13,000.	Leigh Construction (Havant) Ltd. Harcold Refrigeration Co. Ltd.

Small-scale Processing Machinery

In this, the third article in the special "Manufacturing Chemist" series, tableting equipment suitable for pilot scale development work is discussed. Dr. Carless first briefly reviews the principles of tablet making. Where the principles may influence the choice of equipment, these are indicated. However, an empirical approach is often necessary because of the large number of operations involved which as yet are incompletely understood.*

TABLET MAKING EQUIPMENT

By J. E. Carless,[†] Ph.D., M.Sc., B.Pharm., F.P.S.

TABLETS retain their popularity as a convenient means of administering an accurate dose of one or more medicines or drugs, because on a large scale they can be produced economically, they have a good storage life and are easily handled and packed. With the recent introduction of high-speed machines, for example the Manesty Rotapress, output may be as high as 5,000 tablets a minute, although the output with the conventional rotary machine is usually 300 to 1,500 tablets a minute.

The most critical operation of tablet making is the processing of the materials so that they flow evenly into the die and bond on compression, without sticking to the punches, to produce a smooth surfaced tablet which is easily ejected from the die. The object is to produce a tablet that contains the correct amount of medicament, is of uniform weight, is of elegant appearance, is strong enough to withstand normal hazards of handling and yet will readily disintegrate in water when required. Powders do not flow readily and on compression entrapped air tends to split the tablet. These factors are discussed later. For the granulation of powders to produce free flowing material having the desirable properties outlined above, the following additives may be necessary.

1. *Filler*—usually a powder, e.g. lactose, to increase the bulk of the active ingredients when present in insufficient amounts to be tableted alone. Readily soluble fillers im-

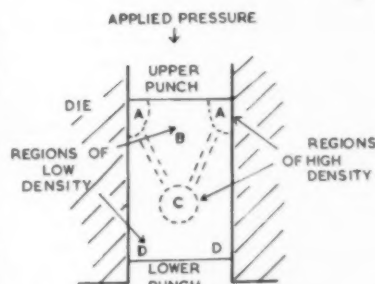


Fig. 1. Conditions in compact before applied pressure is released.⁶

prove the disintegration, whilst adhesive fillers, e.g. sucrose, may supplement the binder and so increase the tablet hardness.

2. *Binder*—necessary when the powders are not sufficiently adhesive. Gums, gelatin and sugars are frequently used.

3. *Granulating fluid*—only used for wet granulation. Water alone may be sufficient, but for powders that tend to become sticky the dilution of water with acetone, alcohol or iso-propyl alcohol will give a more easily workable mass.

4. *Disintegrator*—breaks the tablet apart when wet, due to swelling. Starch is frequently used. Not required for lozenge type tablets.

5. *Lubricant*—frequently a powder is used, e.g. magnesium and calcium stearates and talc, to reduce die wall friction and prevent the tablet sticking to the punches. Liquid paraffin may also be used.

Any one of many different formu-

lations based on the above scheme may be satisfactory. There is generally no hard-and-fast rule, but it is desirable to keep the formula as simple as possible. A discussion of the relative merits of different excipients is outside the scope of this article and reference should be made to publications of Little and Mitchell,¹ and Silver and Clarkson.²

The two main methods of producing granular material are wet granulation and slugging.

Wet granulation

This is applicable to practically any powder or mixture of powders provided that they are stable to moisture and heat. The hardness or solubility of the tablet can be readily controlled by using suitable binders and granulating fluids. Non-aqueous solvents may be used for water-sensitive materials. The method consists essentially of intimately mixing the powdered active ingredients with any necessary filler and binder, etc. The granulating fluid is added until a damp coherent mass is formed. This is then forced through a coarse sieve to assist in uniform drying, dried to remove moisture and then resieved to break down agglomerates. Disintegrator and lubricant may then be added before tableting.

* "Emulsifying Machinery," by G. W. Ridout, appeared in March and "Mills and Sieves," by the same author, in April.

[†] Reader in Pharmaceutics, Chelsea College of Science and Technology, School of Pharmacy.

Slugging

This is used where moisture- or heat-sensitive medicaments prohibit wet granulation. The powdered ingredients and powdered additives are blended together and then compressed in a heavy duty machine to produce large rough tablets termed "slugs." The slugs are broken down into granules and a lubricant is added as before. Some crystalline materials, *e.g.* aspirin and potassium bromide, can be compressed directly into tablets.

Basic equipment needed for granulation

Wet Granulation

Mixer for blending dry ingredients
and for mixing moist powders
Granulator
Drying equipment

Slugging

Mixer for blending dry ingredients
Heavy duty press (preferably rotary)
Granulator

The process of granulation is based on several unit operations such as mixing and drying, each of which must be carefully controlled, to obtain reproducible results. The compression of granules in a tablet press is easily controlled since it is purely a mechanical operation performed by precision machinery, although the degree of compression and suitable rate of compression will be determined by the physical properties of the granules, the size and thickness of tablet, etc. On economic grounds the granules should be capable of fast rates of compression and any changes in the formulation that make this possible are desirable.

PRINCIPLES OF TABLET MAKING

Powdered materials

These must be processed to ensure they have adequate flow properties to fill the die of the tablet machine uniformly. Powders flow poorly owing to particle/particle friction, resulting in aggregation and bridging of the particles. Powder of high surface areas has low bulk densities due to this aggregation, and the large amount of air trapped can be troublesome when the powder is compressed. If the air cannot escape during compression, then its expansion on the release of the pressure will lead to "capping" or in severe cases to bursting of the tablet. Powders make it difficult to operate the tablet press cleanly because they



Fig. 2. Mixer suitable for mixing of moist powders. 12½ qt. capacity, bench model. (Hobart Manufacturing Co. Ltd.)

tend to cause binding of the punches by reducing the necessary clearances between the moving surfaces. In large-scale production, machines are often fitted with dust extraction equipment.

Granules

Unlike powders granules are free flowing and have higher bulk densities. The particle size distribution should be such that no preferential separation of fine granules from

coarser granules occurs before or during the volumetric filling of the die, since uniform weight of the tablet is dependent on a constant bulk density of the feed. Peck³ has reviewed the theory and methods of granulation and refers to the rates of flow of granules through an orifice. Unlike liquids, the flow rate of granules is independent of the head, so that granule flow into the die is uniform even though the amount of material in the hopper is not constant. Below a certain ratio of orifice diameter to particle size, the flow of particles is very irregular. This should be borne in mind when preparing granules for different sizes of tablet. Newman and Axon⁴ have suggested that the average granules size should not exceed one-tenth of the tablet diameter.

Compression of powders and granules

In recent years investigations of the actual forces and energies involved in the process of compression have been made using machines with pressure or strain gauges distributed through the compact or applied to the surfaces of the punches and die. Instrumented machines have been used by Train^{5,6} and Nelson.⁷ Characteristics of the final tablets, *e.g.* disintegration, uniformity of weight and hardness of tablets, which are related to the formulation and mode of preparation have been investigated by careful standardisation of the method of preparation and the choice of an appropriate test for the final product.

The principles underlying the bonding of particles under pressure are associated with the surface properties of solids, as outlined by Peck.³ When solid surfaces, free from any adsorbed film of grease, etc., are brought into close contact with one another, they adhere, the force of adhesion being proportional to the number of points of contact between the surfaces. On compressing particles together, those that deform will make contact over a wide surface area. Undeformable particles, on the other hand, will not adhere on contact. The bonding of crystalline materials, *e.g.* sodium chloride, potassium bromide, etc., is possibly due to the shearing of the crystal, producing fresh surfaces which adhere together ("cold welding"), and/or interlock with other sheared granules. Train⁵ has shown that for magnesium carbonate at least, the most efficient bonding

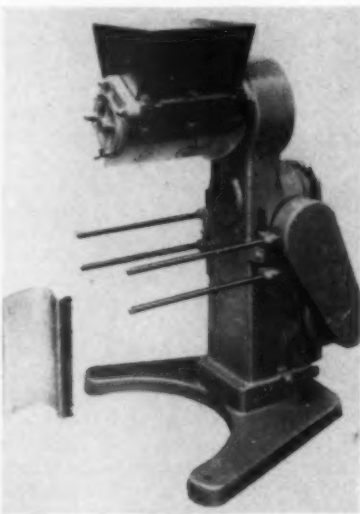


Fig. 3. Oscillating granulator. Size of screen 14½ in. x 15½ in. (Manesty Machines Ltd.)

results if particles are subjected to shear as well as to compressive forces.

When pressure is applied to a powder in a die, as in the case of slugging, the compact will not be of uniform density throughout. The variation of relative density for powder compressed by a punch is shown in Fig. 1. The relaxation of elastic strains when the pressure is released sets up stresses in the less compacted material and is suggested by Train^{5,6} to be the basic cause of lamination or "capping." The main purpose of a lubricant appears to be the lubrication of the powder at the die wall to enable easy ejection of the compact.

It is generally accepted that granules for satisfactory compression should contain a variety of granule sizes, although the presence of excessive dust can be troublesome, since it penetrates between the punches and dies, setting up undue frictional stresses. Up to 15-20% of undersized material or "fines" is acceptable in the granules. The term fines needs defining, since without reference to sieve size it is meaningless. Fine granules, e.g. passing 44 mesh sieve, may be termed fines but can produce good tablets. It is generally the finer particles that pass a 100 mesh sieve that cause trouble.

METHODS OF GRANULATION

Wet granulation

The control of the raw materials is of prime importance for all granulation methods. Substances that are friable tend to shatter on compression and need to be finely powdered, otherwise the granules may not bond satisfactorily on compression. The materials should be obtained dry and powdered or in very fine crystals. Milling of the material may be necessary, since coarse powders produce mottled tablets. A record should be kept of particle size (screen analysis), bulk density and moisture content.

a. Mixing of the ingredients may often be speeded up by sifting all materials through a 20 to 40 mesh sieve into the mixer. The mixer may be a trough type with spiral agitator (to which the granulating fluid can be added to produce the damp mix. Alternative mixers are the vertical paddle types (Fig. 2), which are suitable for materials that granulate easily without undue stickiness. For small-scale work, the domestic food mixers are quite suitable. Excessive

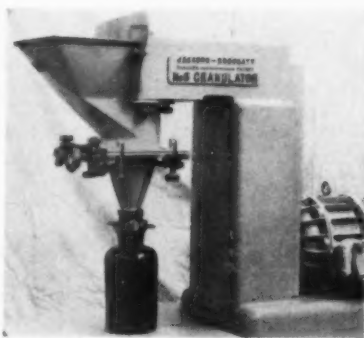


Fig. 4. Reciprocating granulator (laboratory model) fitted with a special outlet for materials requiring aseptic handling. (Jackson and Crockatt Ltd.)

moistening or prolonged mixing will tend to produce hard tablets.

b. Moist granulation. The damp material is passed through a large mesh sieve in an oscillating granulator, or a swinging hammer mill may be used.

c. Drying. The coarse granules are dried at 50°-70°C. in a tray drier for 8-12 hr. This is the usual method, but the recent introduction of fluidised bed dryers can cut the drying time down to 20 min. for a 5 kg. load. This rapid drying may be undesirable when volatile solvents are present, e.g. acetone, since the granules tend to be friable. The formulation may have to be altered to allow for this factor.



Fig. 5. Erweka wet granulator with $\frac{1}{2}$ h.p. motor and three speeds, 200, 250 and 350 r.p.m. Lower speeds possible by use of rheostat.

d. Dry granulation. The dried granules which will have clumped together are passed through a smaller mesh sieve in the granulating machine.

e. Dry mixing. The mixing of disintegrator and lubricant with the dry granules is preferably done in a tumbler type mixer to minimise the proportion of "fines." If the disintegrator and lubricant are mixed with the original powders, this last mixing operation can be omitted. Munden *et al.*⁸ have reported on the efficiency of "internal lubricants."

f. Moisture content. Some granules do not tablet satisfactorily if overdried, a moisture content of 1-2% often improving matters. Determination of moisture content before the dry mixing stage (e) is desirable, since additional moisture can be added at this stage. For even distribution of moisture, acetone/water solution can be used. Starch which is used as a disintegrator may contain up to 10% moisture, so that 5-10% starch will introduce 0.5-1% moisture into the granules.

Slugging

For the compression of powder into "slugs" a rotary machine is preferable to a single punch machine because:

1. Powder feeds more uniformly into the dies.
2. Compression is more gradual and the dwell time under pressure is longer, which helps to consolidate the compact.
3. Density of the compact is more uniform, due to double punch compression.

Single punch machines are generally more difficult to keep clean than rotary machines. An overload release is desirable on all machines to avoid jamming due to uneven filling of the dies.

a. Operation of slugging machine. The following factors should be considered.⁹

1. **Machine size.** Experimental slugging may be done on the smaller rotary machines, although the size of the slug may have to be restricted in diameter in order to exert the necessary pressure. For instance a press with a maximum pressure of 4 tons with $\frac{1}{2}$ in. diameter punch produces 9 tons per sq. in. Small diameter dies are not, however, conducive to even filling. For economic rates

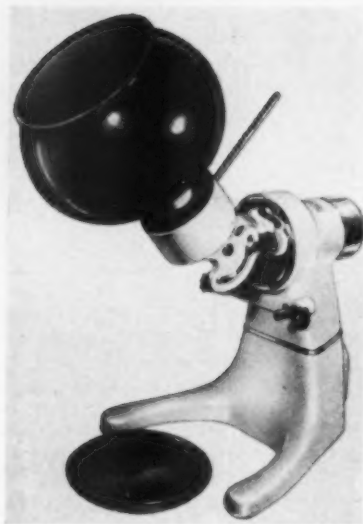


Fig. 6. Erweka coating pan, diameter 11 in. and 15 in. 120 W infra-red radiators are used for drying the tablets.

of production, slugs of about 1 in. diameter and $\frac{1}{2}$ in. thick are desirable.

2. **Pressure.** The amount of pressure used should be less than that required to make the final product if non-porous smooth tablets are to be produced. Exceptions to this are crystalline materials such as aspirin.
3. **Speed.** Variable speed machine is desirable, since slow speeds may be necessary to improve filling and compression. Even at slow speeds the material may be better compacted by a second slugging or with a double rotary machine, double compressed.
4. **Punches and dies.** Flat-faced punches are preferable and the upper punches may need larger than normal clearances to enable the air to escape between the punch and the die. Bursting of tablets due to entrapped air may be reduced by use of tapered dies.

If the material does not form firm slugs, the inclusion of a high molecular weight polyethylene glycol may act as a binder and also as a lubricant. Compressing the powder warm or the inclusion of a small amount of moisture will sometimes help the slugs to bond.

b. Granulation of slugs. Oscillating granulators or hammer mills may be used. On ageing slugs of crystalline material tend to harden and produce less fines.

EQUIPMENT

Thorough mixing of the dry powders before wet granulation or slugging is essential for producing a uniform distribution of individual ingredients. Powder mixing will be discussed in a later article in this series.

Granulators

Oscillating Granulator (Fig. 3). The moist material is fed into the hopper and the oscillating motion of the rotor bars rubs the material through the stainless steel screen, so that the granules can be collected on shallow trays supported below. The rotor bars are mounted cylindrically and move over the curved screen which can be tensioned along the whole length of the rotor. The screens are interchangeable; for moist granulation a 6-12 mesh is used and for resieving the dried clumped granules a mesh from 12 to 20 is used depending on the size of the tablets. Although this type of granulator can be used for reducing slugs to granules, the wear on the mesh may be considerable.

Reciprocating Horizontal Granulator. The interchangeable stainless steel mesh is clamped flat between two horizontal plates and the material is spread over the screen by a four-armed rotor. The bench model shown in Fig. 4 has 6-in. rotor arms and can granulate from 84-140 lb./hr. The use of a flat mesh simplifies the mounting of the sieve and a long sieve life is claimed for this design.

Extrusion Type Granulator. For the granulation of material containing a high proportion of sugar or very soluble extracts, which produce plastic sticky mixtures, extrusion through a perforated screen can be used. The material is fed through the stainless steel hopper which is in two halves, the lower half of which consists of a perforated screen. The screens are interchangeable and are available with holes from $\frac{3}{8}$ in. to $\frac{1}{4}$ in. in diameter. A rotating arm feeds the material on to the multi-armed spreader which forces the material through the screen.

Miscellaneous Equipment. For small-scale experimental work, the units produced by Erweka offer a versatile range of equipment. The basic unit is a $\frac{1}{2}$ h.p. motor with three-speed control, to which individual attachments can be easily attached. The wet granulating unit consists simply of a rotating disc with serrated openings against which the

damp mass is pressed with a hinged pressure plate (Fig. 5). Two standard discs have openings of 14-20 mesh and 16-35 mesh, and although the screening area is small, outputs of up to 25 kg./hr. are claimed. For granulating slugs, they are passed through a pair of rollers with interlacing grooves. The recommended slug size is about $\frac{1}{2}$ in. diameter and $\frac{1}{8}$ in. thickness. Using "hard" slugs the following is stated to be a typical granulation: 24%-16 mesh; 25%-24 mesh; 10%-70 mesh; 20% <70 mesh. Coating pans (Fig. 6) can also be attached.

Hammer Mills. In recent years these have been developed for wet and dry granulation. One model consists of a chamber in which is rotated at high speed a rotor bearing dual faced blades. The lower part of the chamber holds interchangeable screens. For granulating slugs and for wet granulation, knife-edged blades are preferable to reduce the amount of fines. For sticky or plastic granulation the mill is used at high speed without a screen, using a hammer face. The change from knife face to hammer face is made by reversing the direction of rotation of the rotor. The speed of the rotor, size of screen and type of blade can all be varied, giving the machine great flexibility. Generally the granules produced are more regular in size than those produced by the previous methods. The Manesty Fitzmill operates on similar principles.

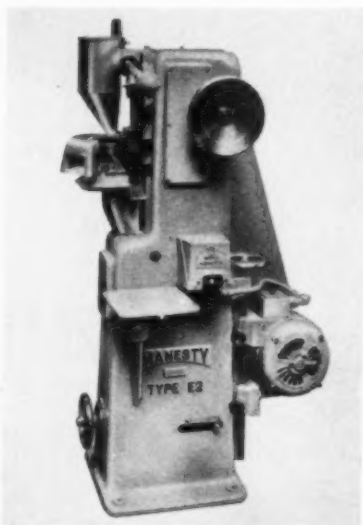


Fig. 7. Manesty single punch machine (E2) for tablets up to $\frac{1}{2}$ in. diameter. Output 42-85 per min.

COMPRESSING MACHINES

Single-punch machines. For preliminary experiments in formulating tablets up to $\frac{1}{2}$ in. diameter, a hand machine can be used. In a typical machine the upper punch motion is transmitted through a ball and socket joint which can be easily dismantled should the punches jam in bottom dead centre. Adjustments for weight regulation and position of lower punch on ejection stroke are made on the lower plunger. Total pressure exerted is about $\frac{1}{2}$ ton and output of tablets is about 100/min. for limited runs.

The advantage of the heavier type of machine, as the example shown in Fig. 7, is that an automatic release mechanism can usually be fitted to protect the machine against excessive pressures. This functions by spring loading the lower punch, the tension on the spring being adjustable. Used in conjunction with a hydraulic gauge that measures the tension of the spring, the actual force in tons exerted on the lower punch can be estimated. On this machine a variable drive can be fitted to give outputs from 42-85 tablets/min. Tablets up to $\frac{1}{2}$ in. can be made.

Rotary Machines. If the final production of tablets is to be done on a rotary machine, then it is advisable to use a similar machine for development work. The Manesty D3 (Fig. 8) is an example of the smaller type rotary capable of making tablets up to 1 in. diameter.

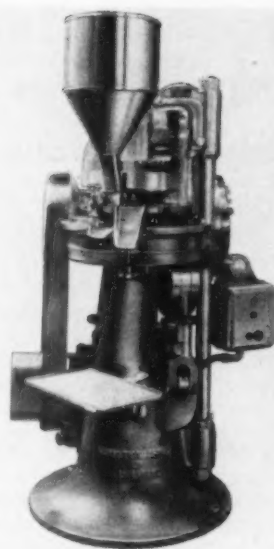


Fig. 8. Manesty rotary machine (D3A) for tablets up to 1 in. diameter. Output 250-500 tablets per min.

The maximum total pressure exerted is $8\frac{1}{2}$ tons. Production of say $\frac{3}{8}$ in. slugs should be possible depending on the materials used. For development work, high-speed outputs are uneconomical, but by "blanking off" all but one of the dies and using only one pair of punches the output is reduced to a reasonable level. Since tablets are compressed near the top of the die the following advantages are obtained:

- (a) Tendency for "capping" reduced.
- (b) Reduces wear on punches and die.
- (c) Dies can be reversed when worn at top.

Unlike single punch machines the pressure is applied from above and below. Embossed or engraved punches produce clear impressions on the tablets, since the pressure is maintained for a short time during the compression. An overload release is fitted.

If the powder will form satisfactory slugs, the preparation of tablets directly from powder may be possible if the die cavity can be uniformly filled. The Colton Induced Die Feeder is used for this purpose (Fig. 9).

Compression coating. Equipment for dry coating of tablets has been recently reviewed.¹⁰

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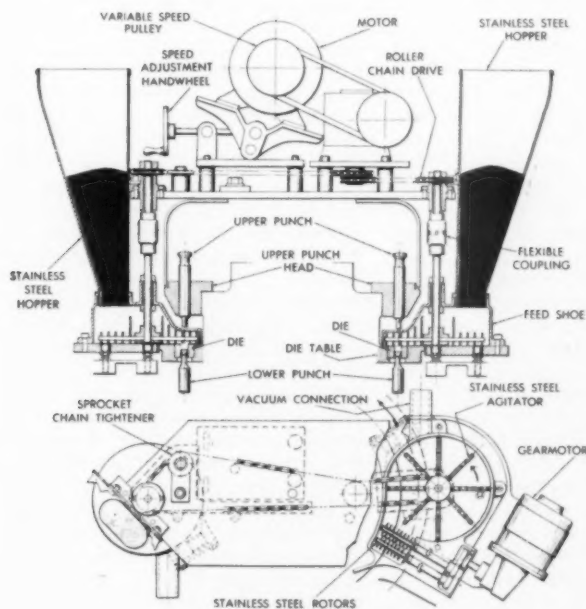


Fig. 9. Colton induced die feeder. (Arthur Colton Co., Michigan.)

Fire protection in factories.

The report "Fire Protection in Factory Buildings," published for D.S.I.R. by H.M.S.O. (price 3s. 6d.) provides for factory managements and building designers an introduction and a guide to the various legal requirements.

The report also indicates what precautions may be taken beyond those required by law to reduce fire hazards. Precautions that should be adopted for the safety of personnel are also considered.

Appendices deal with common causes of fires in factories, standard fire resistance tests and the behaviour of materials and structural elements under fire conditions.

Advances in Sterilising Surgical Products and Drugs

International Symposium in London

New developments in sterilisation methods used in pharmacy and medicine were discussed at a symposium organised last month in London by Smith and Nephew Research Ltd. and the Pharmaceutical Society of Great Britain. Considerable interest was aroused by the new radiation and gas sterilisation methods. Summaries of these and other papers are given in the following article.

Ionising Radiation

High Energy Electrons for Radiation Sterilisation. By John G. Trump.

ALL forms of ionising energy are capable of modifying or destroying all forms of life, depending on the dose. The efficiency of sterilisation is dependent upon the type of energy employed, the susceptibility of the organism, its concentration in the medium, the nature of the medium, and the conditions of irradiation.

The following criteria provide a basis for evaluating the usefulness for sterilisation of the several forms of ionising energy:

(1) The ionising agent should preferably be of the type which accelerates electrons within the absorber. Ultraviolet light is acceptable.

(2) The ionising energy should be capable of penetrating to an adequate depth within or through the absorber as well as delivering an approximately uniform dose. Electrons seem to be best suited.

(3) The ionising energy should be available in quantity and economically. The processing capability of high energy electrons appears to be both safer and greater.

(4) The source of ionising energy should permit irradiation of the medium in any state.

(5) The ionising energy absorbed in the medium must be capable of accurate application, measurement, shielding and control. High energy electrons are again most suited.

Unlike X-rays and γ -rays electrons are the most numerous, lightest, most readily available, swiftest and the most penetrating of the electrified particles. When a directed beam of megavolt electrons impinges on a complex absorbing material containing micro-organisms an enormous number of electrons are

in contact with a far larger number of absorber atoms. Although individual encounters are random in this transfer of energy the general overall effect is predictable, measurable and susceptible to quantitative control. Within any molecule of the absorber, the biologically important acts of excitation and ionisation are accomplished by any electron in the transit time of 10^{-14} sec. The biological efficiency of this radiochemical action is so high that most living structures such as cells or micro-organisms are destroyed by a dose which ionises less than one in a million of their atoms.

Naturally radiation varies with the depth of the absorbing material and it is important to make sure that the least irradiated portion receives an adequate dose without excessive irradiation of the other portions.

Back-scattering of high energy electrons causes a considerable amount of energy waste, especially in absorber materials of high atomic weight. It can be anticipated that most of the materials of the surgical and pharmaceutical industry would cause very small back-scattering of the incident electron energy unless high-atomic-number materials were purposely added to the field.

Various techniques can be used for irradiating samples. High energy electrons emerging from a highly evacuated acceleration tube can be scattered by various means in order to spread the electron energy over a wider area. With appropriate conditions the central portion of the beam can be used for the uniform irradiation of stationary samples. Using an over-focused short solenoidal magnetic lens placed in the electron beam axis a similar spread-

ing of the beam can be obtained, but without as much loss as using scattering foil. Either method can irradiate a moving belt with excellent uniformity, but these simple methods are generally wasteful of electron beam power and are therefore not preferred for production line processing.

An attractive method for conveyor belt applications is an electron beam in the form of an extended ribbon—this can be simulated by scanning a conventional beam rapidly to and fro by a deflecting a.c. magnetic or electrostatic field. To double the effective range using the same electron objects can be irradiated from opposite sides or by rotating cylindrical product containers.

Typical doses

Each organism exhibits a characteristic resistance to radiation and the bacterial and viral count diminishes exponentially with absorbed ionisation dose. Among bacteria, spore forming organisms are the most resistant to irradiation—hence *Bacillus subtilis* have often been selected as test organisms. Viruses are even more resistant than spore formers, e.g. about 30,000 rads of ionising energy are required to reduce the population of *B. subtilis* by 50%, but for a 50% lethal dose for vaccinia diluted in plasma 200,000 rads are needed. A dose of 1 million rads should safely sterilise a medium contaminated with 10,000 *B. subtilis* spores per ml. About 1.3 million rads would similarly attenuate an initial count of 10 million spores per ml. Quite commonly, sterilisation doses of 1 to 2 million rads are given to ensure a completely safe margin.

The electron dosage can be determined with great exactitude, since it depends on the number of electrons which impinge on each sq. cm. of

absorber. The electron voltage merely controls the depth to which this dose is delivered.

The advantages of machine sources of ionising energy (Van de Graaff accelerators, etc.) arise from their adaptability to varied product needs, from their intense

and directed output with the associated compactness of the shielded radiation vault, and from the safety inherent in a controllable machine. The advantages of cobalt and caesium lie in the generous penetration of their γ -rays and the future low cost of isotopes.

Irradiation Plants

Design and Production of Irradiation Plants. By L. G. Burnard.

THERE are two ionising methods now in use, one employing high energy electrons from a particle accelerator and the other using γ -radiation from a radioactive source, generally Co^{60} . There are advantages and disadvantages with both systems that must be considered in design, such as ease of shielding, maximum utilisation of radiation, special maintenance, etc., but γ -radiation has the advantage of being 100% positive.

Considerations that must be taken into account when designing the type of machine include size of units to be irradiated, uniform exposure on all sides, uniform time of exposure, absolute safety of operators and easy replacement of ionising material.

Irradiation using Co^{60} falls roughly into three categories: up to 15 kilocuries; from 30 to 100 kilocuries; and 100 kilocuries and upwards. The first group may be designed for batch loading using rotary cylinders holding the packaged material surrounding the central source. The second two categories would be designed with conveyor systems to maintain a continuous throughput of irradiated material.

Of the three systems, consider a monorail system using 30 to 100 kilocuries—although many of the factors are applicable to the other two systems. The main considerations are reliability, safety, economy, source design, package circulation system, efficiency and operational factors. The system must operate without maintenance for a very long time and it must be completely safe to operate. The monitoring and interlock systems must be absolutely reliable and foolproof.

Maximum use must be made of all available radiation. Four banks of packages on either side of the source is about the most economical arrangement. The source itself takes the form of a skeletal structure

(source plaque) arranged to hold the necessary Co^{60} rods. The size and length of the plaque is a function of the total strength requirement and new rods are added to the frame to keep up the source strength. The source is submerged in a pond and can only be raised when conditions are such that it is safe to do so. The whole structure is housed in a concrete biological shield.

Gas Sterilisation

The Sterilising Properties of Ethylene Oxide. By Charles R. Phillips.

AFTER briefly mentioning the basic chemical, physical and biological properties of ethylene oxide, the paper discusses how its bactericidal activity is influenced by moisture. Some of the advantages of ethylene oxide as a sterilising agent include: few materials damaged, effective at room temperature, effective at low humidities, little residual effect, bactericidal not bacteriostatic, effective against all organisms, good penetration.

Its disadvantages include: slow action, requires special equipment, toxic, costly, flammable. The point that must be stressed is the fact that it is effective at low humidities. It has been found that some moisture is necessary but that a little is better than a lot. It would seem that the difficulty in achieving sterilisation at very low moisture content could be either mechanical (poor penetration through a hard dry crust of material) or chemical (no alkylating reaction taking place without sufficient water to make ionisation of a hydrogen atom possible).

Recent experiments, still in progress, have thrown new light on this problem. Prepared spores of *B. globigii* were exposed under similar conditions at different relative humidities to a standard concentration of ethylene oxide. Direct plate counts

Packages are irradiated by passing backwards and forwards on either side of the source plaque when this is in the irradiating position. The circulation system is such that each package receives an equal dose of radiation, even if several passes are needed. The minimum amount of conveyor equipment is employed so that there is a minimum wastage of radiation.

The efficiency of the whole unit depends on the proportion of the source radiation actually absorbed in the target material and the uniformity with which this radiation is diffused throughout each unit of the target material. Since it is impossible to switch off the source and conserve radiation, the plant must run continuously and semi-automatically to obtain the maximum economic advantage. The simplicity of the plant ensures that it can be operated by semi-skilled labour.

were then made after 48 hr. of incubation.

Effect of humidity

Results showed that it takes about twice as long to sterilise spores at high humidities as it does around 30% relative humidity. Highly desiccated spores will not react with ethylene oxide and acquire resistance even though exposed at optimum relative humidities. An organism can become increasingly resistant to ethylene oxide sterilisation by dehydration within an hour or so, no matter whether this dehydration is caused by chemical desiccation or vacuum.

At the moment experiments are being conducted to see how this effect can be overcome.

The mode of action of ethylene oxide appears to be in its direct alkylation of the sulphhydryl, imino, carboxyl or hydroxyl groups in the link. When water of hydration is removed rather firm chemical cross-linkages are set up between various parts of the spiral protein molecule. Only when the organism is actually wet are these bonds rapidly broken and replaced by water molecules which in turn can be replaced by ethylene oxide in an alkylating reaction.

Equipment for Gas Sterilisation

Applications and Equipment for Ethylene Oxide Sterilisation. By J. J. Perkins and R. S. Lloyd.

IN THE evaluation of ethylene oxide as a sterilising agent it is essential that a broad spectrum of micro-organisms be employed for test purposes. All studies relating to industrial applications in this paper were necessarily carried out using procedures for sterility outlined in the U.S.P.

The factors upon which sterilisation by ethylene oxide depends are as follows: exposure time, concentration, temperature and moisture. Exposure periods are generally a function of the ethylene oxide concentration. Concentrations can be determined by chemical assay, gas chromatography or an infra-red gas analyser as employed in this experimental work. A chamber temperature controlled in the range 55° to 60°C. is practical for most materials sterilised by this process. The effect of moisture is dealt with fully in another paper. Evidence shows that the resistance of micro-organisms to ethylene oxide in the gas phase is related to (1) the growth phase of the organism, (2) the number of spores or cells within a given volume of suspension or on a given surface area, and (3) the state of hydration of the organism.

Marked improvements in the design, construction and performance of ethylene oxide sterilisers have occurred in the past five years.

Sterility Control

Control of Sterility in a Manufacturing Process. By K. Tattersall.

A MANUFACTURER producing sterile materials must be aware of the applications and limitations of the different processes available for sterilisation. Since sterility can only exist in a container, packaging considerations are of first importance. Having selected a suitable pack the manufacturer is faced with controlling the sterility of the production article. This can be effected in two ways; by testing the finished article and by including in a sterilisation batch test pieces.

Testing a random sample from a treated batch gives results which depend primarily on the number of articles tested. The smaller the percentage of infected articles in the

Plant and controls

Modern equipment consists basically of a sterilising chamber of the pressure vessel type and an automatic control system. The control system includes a vacuum pump for drawing an initial and final vacuum on the chamber, a heating element with temperature controls, valves for controlling the introduction of gas and maintaining the correct pressure, as well as a system for admitting the desired quantity of water vapour into the chamber and maintaining the mois-

Sterility Tests

Methods and Media Used in Sterility Tests. By A. M. Cook.

STERILITY may be defined as the absence of all living micro-organisms in or on the object declared to be sterile.

Since it is impossible to test to this standard it would be better that one tests for "probability of contamination."

There are several criteria for a "probability of contamination test." Adequate sampling of the batch must be made so that the probability of the batch being contaminated can be estimated. The technique of performing the test must reduce acci-

ture level, as well as indicating and recording the relative humidity. In addition it is considered essential to install a bacteria-retentive filter for filtering the air as it enters the chamber following relief of the terminal vacuum.

The paper describes various types of gas steriliser currently in use in the U.S.

Applications for ethylene oxide sterilisation demand attention to certain technical problems which must be solved prior to accepting a standardised cycle for sterilisation. These problems are as follows: packaging materials; residual gas in the exposed article; toxicity of the residual gas; and quarantine periods required for dissipation of the gas from the exposed materials.

dental contamination to a minimum. The technique should not subject the material under test to any antimicrobial agents other than those that are already present. The effect of any antimicrobial substance in the material must be neutralised. The media used in the test must be capable of initiating and maintaining the growth of a small number of micro-organisms, especially pathogens, and the more common contaminants likely to be present in the raw materials or likely to be introduced during processing.

process, gives a very good indication of the efficiency of sterilisation.

The choice of material for the test piece should be governed by the nature of the production article. Generally the level of contamination of the test piece should be at least ten times that of the production article, but stricter control may call for a higher level than this. The use of a specific micro-organism for the infection of the test piece enables a true interpretation of the sterility test to be made. It has also been found that vitamins such as thiamine, nicotinic acid, riboflavin, folic acid, and the amino acids histidine, methionine and lysine are destroyed to a marked degree when exposed to ethylene oxide. Investigations of this type are of considerable help in attempting to define the limitations of ethylene oxide.

Safer and Better Cosmetics: The Scientific Approach

Too many cosmetics are still formulated on a flimsy scientific basis. Better understanding of the nature of the skin is the key to improved and safer cosmetics. How the biologist can help develop cosmetics scientifically was discussed in a paper presented at a recent meeting in New York. We summarise it in the following report which includes two other papers, one on raw materials and the other on the usefulness of radioisotopes in cosmetic research and manufacture.*

The Biologist's Contribution to Cosmetic Development

By William Montagna,[†] Ph.D.

COSMETIC industries thrive upon the unpredictability of human wants. Those who have curly hair strive to straighten it and *vice versa*. It is improper for women to allow hair to grow on the legs or the axilla and at the same time, it is considered effeminate for a man to shave most body hair. High skin colour tones must be softened or masked, dull ones must be accentuated. The commercialisation of certain products said to prevent the expression of body odours has reached the ultimate hysterical pitch.

Granted that manufacturers of the neutralisers for body bacteria may preach the truth as they see it, would it not be edifying if they knew the truth? If one reads Rothman's book¹ and the book of Hurley and Shelly,² one will see that axillary secretion, when sterile, is odourless, but when attacked by certain micro-organisms it becomes fetid. This is the extent of our information. No fetid emanations result from a degradation of eccrine sweat.

Those who have an honest interest in the biological phenomenon of male baldness have to listen to endless inanities. The phenomenon is regarded as a disease and anyone finding preventive measures would become inordinately rich.

Although to survive, cosmetic and toilet goods industries must still capitalise upon vanity they are gradually emerging from arbitrary compounding and are compelled to consider the biological properties of skin for safety's sake. Sound facts must be produced if the industry is to

achieve the high level of respectability that it must. It is hoped that the cosmetic industry is only one step removed from cosmetic dermatology and that each new cosmetic product compounded will be tailored to the biological properties and needs of skin. Skin should either be indifferent to a cosmetic agent, or it should benefit from its presence.

With this in mind, it is easier to talk about the contributions that the biologist has made, or will make, to the industry. Every piece of research is important even if it seems to be of little apparent value at the time.

The skin

Few appreciate the fact that skin properties are enormously different from one part of the body to another. Furthermore, even the same cutaneous organs have different properties in various areas of the body. The sweat glands from the palms and soles have properties anatomically and physiologically different from those elsewhere. Androgenic hormones, which genetically select men, are the prime incitant of baldness, and enhance the growth of the hair elsewhere on the body. The size

and the activity of the sebaceous glands over the entire body respond to androgenic stimulation, but only those of the face, forehead, neck, shoulders, and anterior chest are delicately sensitive to it and prone to acne. The sebaceous glands of the bald male scalp are gigantic and enormously active, but they rarely become sites of acne lesions. The thickness and the properties of the stratum corneum over the different parts of the body vary and must have different properties of penetrability. Studies just under way in two laboratories are beginning to show that the topography of the intact surface of the body varies greatly from place to place.

There are striking differences in the amount of vascularity of the skin from the various parts of the body, details of which are not all known yet. Perhaps the lymphatic drainage is the least known fact about skin; surely this should be of great importance to the cosmetologist.

Anyone who is interested in applying various substances to skin daily should take into account the rate of growth and differentiation, and the chemistry of the surface of the skin. About the last point, the chemistry of the keratin and the lipids on the surface of the skin, great progress is being made. Since 1946, W. S. Bullough, an English zoologist, has been studying the problem of mitosis in the epidermis. He has found that epidermal mitotic activity takes place in diurnal rhythmic cycles, whereas that of the cells of the matrix of hair follicles proceeds throughout the day or night. Epidermal mitosis requires aerobic

* Presented at the Sixth Symposium on Cosmetics co-sponsored by the Committee on Cosmetics and the Section on Pharmacy at the 127th Annual Meeting of the American Association for the Advancement of Science, New York.

Other papers included "New Methods for the Study of Percutaneous Absorption," "Dermatologic Research and Cosmetic Formulation," "The Clinical Dermatologist and Cosmetic Reactions," "Methods of Appraisal for Potential Hazard," "Industry's Interest and Responsibility in Cosmetic Safety" and "The Government's Role in the Control of Cosmetics."

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conditions, the mitotic rate being dependent upon the available energy supply. The energy needed by a cell to divide must be mobilised and stored before that division can begin. All inhibitors of glycolysis, respiration and phosphorylation prevent mitosis in the epidermal cells *in vivo* or *in vitro*. These and other details pertaining to proliferation and differentiation of cutaneous structures are essential information for the cosmetic chemist.

Enzymes

In addition the cosmetic chemist should be fully aware of the enzyme systems of the skin. This information must come from both the chemist and the histochemist. The biochemist has accumulated an interesting list of enzymes found in the skin. This list, however, rarely takes into account the regional differences that exist in skin. Histochemistry, on the other hand, with all of its faults and lack of refinements is useful in demonstrating where a certain chemical substance is located. For example it is known that skin contains a peptidase, but it has been assumed that the source of this enzyme is the pool of lymphocytes in the dermis (Fruton³). We now know that the secretory segment of eccrine sweat glands and the dermal papilla of hair follicles are abundantly rich in leucine aminopeptidase.

A few years ago, Fell and Mellanby⁴ and then Weiss and James⁵ demonstrated that embryonic cutaneous tissues treated *in vitro* with vitamin A undergo mucoid metaplasia rather than a keratinous transformation. Bern and his colleagues⁶ have also demonstrated a mucoid metaplasia in the vaginal epithelium of the rat after the use of large amounts of vitamin A. These are the only bits of "evidence" that vitamin A has antikeratinogenic properties. In spite of this shaky premise both pharmaceutical and cosmetic agencies have been incorporating it in various ointments. In adult rats, mice, and guinea pigs, it has not been possible to inhibit keratinisation even when very large amounts of vitamin A are used. Furthermore, experience with vitamin A shows that it does not go through the intact human skin, although it does penetrate the skin of rodents. Similarly, in spite of the wide topical use of pantothenic acid, there is evidence that it does not easily penetrate the intact skin.

There is a wanton topical use of androgenic and oestrogenic hormones. In most cases the use of sex hormones is either a deliberate attempt to hoodwink the user or a misinterpretation of the known effects of these agents on the skin appendages. It is known that androgenic substances enhance the growth and differentiation of sebaceous glands and that oestrogenic hormones tend to suppress them. It is known also that, at least in the skin of rodents, both of these hormones increase the rate of mitotic activity in the cells of the epidermis. Is this enough knowledge to warrant using these substances in large doses on senile skin? What is known about the ultimate effect of prolonged usage? These are serious considerations that have been ignored both by the pharmaceutical and cosmetic manufacturer.

Sunscreens

On the flimsy assumption that sunlight is good for the skin, substances have been developed that by filtering out ultraviolet light allow one to bake and not burn. Substances have also been developed that give one a sun-baked look artificially. These are good things, since actinic rays are probably among the most devastating known agents to the skin. The most pronounced senile changes take place in the exposed areas of the body and the high incidence of cancer in

the skin exposed to the sun's rays cannot be dismissed lightly.

An important contribution of the biologist to the total understanding of skin is in the field of comparative anatomy and physiology. Few realise that the skin of man is enormously different from that of other mammals. Search is being made for differences and similarities with the intent that eventually these will be annotated so that it will be possible to perform experiments on the skin of specific animals and relate the results to the human skin.

These are only a few of the contributions made by the biologist to the development of cosmetic industries. As new artifices are compounded to put on our skins, the cosmetic industry is going to play an increasingly important rôle. If the industry is going to be beneficial to society as well as to itself, it must depend more and more upon the judgment of the biologist and the physician.

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Radioisotopes in Cosmetic Research

By William F. Bousquet,* Ph.D.

THE COSMETIC industry has technical and research problems not unlike those encountered in the food and pharmaceutical industries, which are making extensive use of radioisotopes and ionising radiation. It is likely that isotope techniques will find broad application in cosmetic research and technology.

Properties of radioisotopes

Radioisotopes differ from stable isotopes in that they possess excess energy in the nucleus of the atom. As a radioactive species attempts to

attain a more stable state it loses its excess energy in the form of ionising radiation. The type of radiation emitted by the radioisotope, the energy of the radiation and the half-life are characteristic of each species. Sensitive electronic equipment has been developed for the qualitative and quantitative assay of radioactivity.

The usefulness of radioisotopes in research and industry is founded on three basic principles.

1. *Radiation affects materials.* This principle is employed in food and drug sterilisation, therapy with radioisotopes and chemical reaction induction. It is dependent upon the ability of ionising radi-

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tion to interact chemically with matter.

2. *Materials affect radiation.* A beam of radiation passing through matter gives up its energy and is reduced in intensity as a function of material thickness and density. Applied to radiography, thickness gauging and liquid level measurement.

3. *Radiation traces material.* Radioisotopes may be used to follow complex biological and chemical systems. The so-called tracer technique has been applied with equal success to metabolic studies in animals and man, penetration of cosmetic ingredients through the skin, and in following the movement of oil through pipelines.

The basic advantages of the tracer techniques are three in number, the first being sensitivity of the method. Radioisotopes can be measured in amounts less than 10^{-12} gm. with high accuracy and precision, whereas most common analytical procedures are far extended at the 10^{-6} gm. level. Secondly, the method is highly specific, and no doubt exists concerning the material being measured. The third advantage is that it may be applied to complex physical, chemical and biological systems.

The areas of usefulness of radioisotopes as research tools are well documented in the scientific literature.

Applications in the cosmetic industry

These fall under two main headings:

1. Cosmetic research and product development.
2. Production, process control and packaging operations in the industry.

It is the first heading which is perhaps of prime consideration. Besides research applications mentioned in this article there has also appeared a review of isotope applications in the detergent and cosmetic fields by Nelson.¹

Radioisotope methods have proved useful in studies involving transfer of materials through the skin, and in phase transfer studies such as would be of interest in product formulation. Transfers of this type can be accurately measured with great sensitivity and simplicity at minute material concentrations under diverse experimental conditions.

Metabolic studies

The cosmetic scientist must know precisely the rate and degree of absorption of ingredients from his formulation through the skin and into the general circulation. In addition, there are problems of measuring blood levels, excretion rates and the identification of metabolic products from cosmetic and dermatological preparations. Tracer techniques provide a rapid, accurate and precise method of solving these problems.

The Food Additives Amendment has generated many problems involving the identification and measurement of minute amounts of residues and metabolites. The use of tracer techniques in these studies is scientifically necessary in the measurement of p.p.m. levels of organic materials in biological media. In any study of a biologically active substance, one wishes to know the metabolic products of the material in the animal body. A study of this nature may provide valuable information regarding the mechanism of action of the substance, and may define the role of the metabolites in any toxic effects noted. By labelling specific atoms or functional groups in the compound with a radioelement, one may readily determine their metabolic fate. To determine if a specific group in an organic compound is completely oxidised *in vivo* to carbon dioxide, the compound is labelled with radiocarbon (C^{14}) and administered to the subject. The expired air is then collected and analysed for its $C^{14}O_2$ content. A quantitative determination of the C^{14} excreted is a sensitive indicator of the route of metabolism of the compound.

In skin penetration studies it appears that the autoradiographic technique would be of particular value. In this procedure the radioactive labelled material of interest is applied to the skin. Skin sections are then taken and mounted. The section containing the radioactive compound is next coated with photographic emulsion, exposed and processed. Since ionising radiation has the ability to activate the photographic emulsion, areas of film darkening correspond precisely to areas of localisation of the labelled compound in the sub-layers of the skin.

Product evaluation

Radioisotopes have proved useful in determining if specifications set

upon various materials and processes are being met. Tracers are useful in evaluating the completeness of mixing of many blended products. In the detergent and cosmetic industries studies of the adsorption and removal of soils and other debris from clothing and skin have been carried out using isotopes.

Similar techniques have been applied to product and process evaluation problems in the cosmetic and pharmaceutical fields with success. Examples of such uses are listed below.

1. Studies of ingredient migration through and out of various matrices. Applied to studies of ointment and cream bases.^{2,3}
2. Evaluation of astringent preparations for their ability to affect ion transfer through membranes.⁴
3. Studies of ingredient release from emulsions. Rating of emulsifiers by release measurement procedures.
4. Studies of emulsion stability by following the rate of creaming and cracking by tracer procedures.

For a more complete survey of applications and techniques the reader is referred to a recent report by Christian and Bousquet.⁵

Applications to manufacturing and packaging

Nuclear technology has been successfully applied to industrial process control.

Examples of operations suited to control by nuclear gauges are the following:

1. Package fill monitoring and control.
2. Measurement and control of material thickness.
3. Measurement and control of material moisture content.
4. Flow rate control in closed systems.
5. Measurement and control of material density.

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The Science of Safe Cosmetic Formulation

By Glen J. Sperandio,* Ph.D.

RETAIL sales of cosmetics in the U.S. now exceed a billion dollars a year, but it is only within the past few decades that their manufacture has had any governmental supervision and that much official thought has been given to safety. As cosmetic formulations become more precise and their production more scientific, the industry assumes greater obligations to the consumer and consequently becomes more important in the eyes of the law.

A safe cosmetic must satisfy six requirements.

1. It must be able to be used by any normal person indefinitely without producing any kind of harmful reaction.
2. If excessively used, or misused, or even taken internally, it must not cause serious or lasting effects.
3. It must contain only ingredients which have been proved to be non-harmful to humans.
4. It must be formulated to support the claims made for it by the advertisements.
5. Its development must be based on established scientific facts.
6. It must remain physically and chemically stable.

There are four major causes of unsafe cosmetics. First, components of the products may be irritating or injurious; second, therapeutic agents in cosmetics may exert side effects; third, some cosmetic preparations can produce sensitivity in allergic individuals; and fourth, products may decompose to form harmful substances.

Thus, cosmetic development consists of the proper combination of scientific principles and technical processes, and many different facets are involved before a product is marketed. To meet the specifications for a safe cosmetic there are several essential considerations.

First, all ingredients must be tested. Only substances which have been proved harmless to humans should be considered in any cosmetic formula. Each component should be used for a specific purpose and in quantities which will ensure its maximum effectiveness.

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An important part of every cosmetic is the skill of the formulator. Good cosmetics are not just put together and mixed haphazardly.

It takes additional skill to extend a laboratory formula to large-scale production, and here again the knowledge and experience of the formulator contribute to safety. Every batch of a cosmetic must be identical and this necessitates detailed and controlled manufacturing procedures.

Supplementing controlled manufacture is a quality control programme. Each cosmetic manufacturer must check his products both qualitatively and quantitatively. Standards for physical properties of the cosmetics must be maintained and assays for any active ingredients should be routine.

There are additional ways in which the safety of a cosmetic can be enhanced. One of these is by proper packaging, since most cosmetic preparations are perishable and many of them are easily broken down.

Another contribution to the safety of a cosmetic is the label on the container which should have clear and adequate instructions for its use. In addition, the label should indicate any ingredients which might conceivably cause reactions in allergic individuals.

Proper advertising and promotion can also make cosmetics safe. If the consumer is told what a cosmetic should do, and how to use the cosmetic to make it accomplish its purpose, the possibility of misuse is minimised.

Finally, research is essential for the production of safe cosmetics. The cosmetic industry must support fundamental research projects if it is to continue to serve the public. The modern formulator must apply theoretical research to his practical problems as well as using knowledge obtained from other scientific fields.

A major contribution to the production of safe cosmetics has been the co-operation between the cosmetic manufacturers in sharing information. The literature of the cosmetic scientist alone presents subject matter ranging from organic chemistry to physics and from production techniques to biological and physiological phenomena. The term "cosmetic

scientist" is an appropriate description of the modern formulator. He must have both academic training and industrial experience.

It can be seen that special academic training is necessary for anyone responsible for producing safe cosmetics. He must have a good grounding in the physical sciences, including chemistry and physics, as well as the biological sciences, particularly physiology, pharmacology and bacteriology. He must have a sound knowledge of public relations in as much as communications and advertising are concerned; and he must know the essentials of compounding, manufacturing and production. One qualified candidate to fill this position is the pharmacy graduate, and from him will emerge the specialist cosmetic pharmacist.

Development of safe cosmetics

As an example of original formulation, consider how a safe cosmetic might be developed.

The very safest materials that might be used in cosmetics are foodstuffs. Since they are safe for human consumption, then why not for external application as well? They offer most of the types of materials needed for cosmetic formulation: oils, creams, starches, proteins, lubricating and protective materials; and their safety has been established beyond doubt. Certain products have already been investigated along these lines. The first is a complexion lotion, the two main ingredients of which are peaches and cream. A second preparation is a hand cream made essentially from tapioca.

These examples show that with a little originality safe cosmetics can be produced from limited raw materials. These experiments may well be the solution to problems which may arise as the result of future regulations concerning cosmetic ingredients.

Therapeutic cosmetics

These cosmetics have been formulated for a specific physiological and/or pharmacological action, and by their use many dermatological problems will be solved.

(Continued on page 228)

New Factory for Bristol-Myers Products

Bristol-Myers Co. Ltd. have opened a new factory for making their proprietary medicines and toilet preparations. It is at South Ruislip, near London, on the site of the Angier Chemical Co. which Bristol-Myers bought in 1952.

THE NEW BUILDING is of strikingly modern design, and provides 58,000 sq. ft. including offices. Attractive colour and design are used throughout and the bright tone of the building is set by the main entrance hall, which employs rosewood paneling and plate glass, with a stairway leading to two floors of offices, board-room and canteen. Windows on the main office corridor give a panoramic view of the factory floor.

Factory layout

The manufacturing system employs a U-plan layout. Raw materials are stored at one end and the finished product ready for despatch is stored at the other. In between raw materials are processed, containers are filled and packed in batches, orders are made up and finally stored for despatch. Automation is such that the factory has been able to expand with only a small increase in staff. About 100 people are employed in both factory and offices.

Raw materials store

Samples of all raw materials are taken immediately on arrival and physical and chemical tests are carried out in the control laboratory, which is situated next to the store. When they are required for processing, the materials pass on to a mezzanine floor above the store, which is the manufacturing area. Liquids are pumped up to this floor, as required, from drums below.

Processing area

The mezzanine floor is large enough to provide plenty of working space for the operators. Each reaction kettle is conveniently situated for easy access and for piping the product down to the ground floor filling lines.

Products made here include Angier's emulsion, *Ingram* shaving cream, *Ipana* toothpaste, and *Mum* deodorant lotion, roll-on applicator and cream. *Supavite*, both double and single multivitamin capsules, are made under contract to Bristol-



Bristol-Myers' new factory at South Ruislip for making proprietary medicines and toilet preparations.

Myers specifications by R. P. Scherer at Slough.

Before the raw materials are incorporated in the processes, they are re-tested for purity. The required amounts are then weighed and all operations are carried out in batches. After the reactions are complete, the finished product is perfumed if necessary and again tested to check that it complies with the standard specification before it is pumped either straight down to the filling lines or to storage tanks until required.

The chemist in charge of this section has his own laboratory on this floor which is used for control checking of the processes and for dealing with any other problems which may arise with regard to purity of materials.

Tableting rooms

On the ground floor there are two rooms for making aspirin tablets. There are two varieties—Angier's *Junior* aspirin which is orange flavoured and *Bufferin* which is buffered to reduce acidity in the stomach.

After formulation and mixing *Junior* aspirin is granulated, oven dried and then tableted on the usual rotary machines.

Bufferin tablets are made under conditions of controlled humidity and temperature. This is due to the fact that they discolour if exposed to normal conditions. The materials are mixed, tableted and coated at a relative humidity of 40 and a temperature of 60°-75°F.

The filling lines

These are placed below the mezzanine floor so that products can be easily pumped down. Packaging materials pass from the stores under the mezzanine floor and meet the manufactured product. The packaging lines include bottles for the aspirin tablets, collapsible tubes for toothpaste and shaving cream, and special applicators for *Mum* rollette.

Tablets are carefully checked for size and then filled in a special machine designed by Bristol-Myers. Fifty tablets at a time are filled into the bottles, packed with cottonwool

(Continued on page 226)

ANALYTICAL CHEMISTRY

By C. A. Johnson, B.Sc., B.Pharm., F.P.S., F.R.I.C.

Fluoride determination • Pesticides and herbicides • Fine chemicals
Drugs and pharmaceuticals • Fixed and essential oils • Steroids

Fluoride determination

THE determination of fluoride, both as a trace impurity and as a means of estimating the fluorine content of organic compounds, is becoming increasingly important. In the past, colorimetric methods of determination have depended upon the bleaching action of the fluoride ion on a metal-dye complex. More recently a completely new approach has been made possible with the discovery of a reaction in which fluoride actually enters the metal-dye complex to produce a new coloured species. The reaction was first described as a qualitative test by Belcher, Leonard and West¹ who later applied it to the analysis of fluorine-containing compounds on the sub-micro scale.² Theoretical considerations of the reaction have been discussed by Leonard and West.³

The method depends upon the formation of a red chelate between cerous ions and the dyestuff alizarin complexan (1,2 - dihydroxy-anthaquinon - 3 - ylmethylamine - NN - diacetic acid). When this chelate is treated with fluoride ions at a pH of about 4.3 a blue complex is formed in which it is postulated that fluorine replaces one of the co-ordinated water molecules remaining on the cerium (III) atom. Absorption curves for the yellow alizarin complexan, for the red chelate with cerium (III) and for the blue complex with fluoride, all measured at pH 4.3, are shown in Fig. 1 which is reproduced from Leonard and West's paper.³ This figure also shows the absorption curve for alizarin complexan at pH 12.4. The fluoride reaction is also obtained if cerium in the complex is substituted by either lanthanum or

praseodymium, but other rare-earth metals examined, although they chelate with alizarin-complexan, give no reaction with fluoride. The colour developed appears to be specific for fluoride although certain ions interfere, notably aluminium, iron and various chelating anions such as oxalate, tartrate and ethylenediaminetetra - acetate. Phosphate causes a decrease in colour intensity of about 10% when it is present in a seven- to eight-fold molar excess over fluoride. Sulphate and chloride are virtually without effect on the reaction.

It seems clear that this method is ripe for further development and a paper describing the semi-micro determination of fluorine in organic compounds has already appeared.⁴ The authors use the flask combustion technique to burn quantities of from 5 to 25 mg. of compound

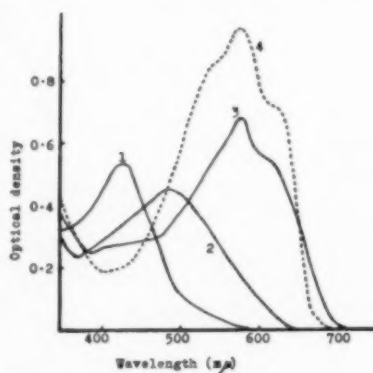


Fig. 1. Absorption curves for (1) alizarin complexan, (2) alizarin complexan-cerium (III), and (3) alizarin complexan-cerium (III)-fluoride, all at pH 4.3, and (4) alizarin complexan at pH 12.4. (Reproduced from *J. Chem. Soc.*, 1960, p. 4482.)

(fluorinated steroids, hydroflu-methiazide and Tufnol are among the several materials examined); combustion products are absorbed in water and the alizarin complexan method is applied to a suitable aliquot. It was noted that when combustion of fluorine-containing compounds was carried out in borosilicate-glass flasks consistently low results were obtained. This difficulty was avoided by using flasks constructed either of silica or of boron-free glass.

Pesticides and herbicides

Residues. The pressing problem of the determination of pesticide residues in foodstuffs has been referred to in a previous report. A significant contribution has been made by workers at the Woodstock Agricultural Research Centre⁵ who have used gas chromatography for the detection in crop extracts of chlorinated insecticides such as aldrin and dieldrin at levels in the region of 0.1 to 0.5 p.p.m. without prior "clean-up" of the extracts. An argon detector is used which exhibits negative peaks for these chlorinated compounds, particularly when the applied potential is low. DDT and BHC are detectable at similar levels but there is evidence of breakdown of the former compound on the column. Endrin is also thought to decompose on the column since multi-peak chromatograms are obtained.

A colorimetric method for determination of dieldrin residues in animal fat has been investigated by Cueto.⁶ The method is based upon reaction with diphenylamine in the presence of zinc chloride to yield a purple colour which is measured in acetic acid solution at 650 mμ. The fat is first subjected to alkaline hydrolysis (a treatment which destroys many other chlorinated insecticides that might interfere) and the dieldrin is extracted into hexane. Chromatography on an alumina column is used to clean up the extract and the eluate is evaporated to dryness for application of the colorimetric reaction. This type of reaction has been applied by Graupner and Dunn to the determination of toxaphene residues.⁷

Olive crops are sprayed inten-

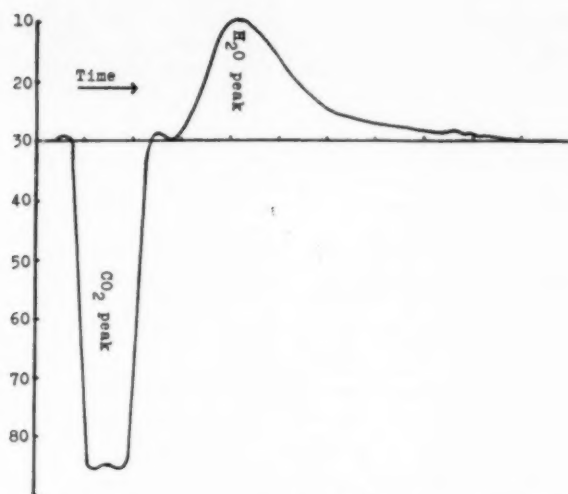


Fig. 2. A typical chromatogram obtained in the determination of carbon and hydrogen in organic compounds by the method of Vogel and Quattrone.¹¹ (Time units in minutes.) (Reproduced from *Anal. Chem.*, 1960, 32, p. 1755.)

sively with various insecticides and Italian workers are continuing to develop methods for the determination of residues in the oil. Doretto⁸ has applied the methylene blue reaction to the determination of diazinon in olive oil and claims results accurate to 0.5% at the 0.5 p.p.m. level when a 20 g. sample of oil is used. The oil is extracted with hexane and alkali and diazinon is removed from the organic layer by washing with hydrobromic acid. The acid extracts are hydrolysed by boiling for 2 hr. in a current of nitrogen, liberated hydrogen sulphide being passed into zinc acetate solution. Addition of *p*-aminodimethylaniline and ferric chloride to the solution results in the formation of methylene blue equivalent to the diazinon present in the oil.

Organic phosphates. In a continuation of his work on the paper chromatographic separation of insecticides, Mitchell⁹ has now perfected a method for the separation and identification of 11 organic phosphate compounds, all of which, with the single exception of systox, can be separated from any combination of the others. Certain of the separations are made with one-dimensional chromatography and others with two-dimensional. The complete series of separations is based on the use of four different solvent systems and five reagents.

Pyrethrum. Further work on the analysis of pyrethrum²¹ has now resulted in a method of separation and quantitative determination of

the four biologically active compounds cinerin I, pyrethrin I, cinerin II and pyrethrin II. The procedure depends upon elution chromatography from a charcoal column with light petroleum-ethyl ether (2:3) as solvent followed by spectrophotometric determination. The author admits that the method is tedious to operate and it would presumably not be of value for the routine determination of pyrethrum; furthermore the presence of synergists, surface-active agents and other additives interferes with the separation. For the assessment of special problems, however, such as examination of the degradation of pyrethrum extracts, the technique is useful.

Fine chemicals

C and H determination. Several new methods for the determination of carbon and hydrogen in organic compounds have been described recently. In one of these¹⁰ the carbon dioxide obtained on pyrolysis in a stream of oxygen is passed into an electroconductivity cell where it is absorbed in dilute alkali, the change in conductivity providing a measure of the carbon content of the sample. Water resulting from the pyrolysis is frozen with a mixture of solid carbon dioxide and acetone; the frozen water is then evaporated in a stream of inert gas on to a layer of hot platinised carbon black when carbon monoxide forms and is itself converted to dioxide by passing over heated cupric oxide. The carbon

dioxide is then passed into an electroconductivity cell and measured as in the carbon determination.

A second method¹¹ is based upon gas chromatography of the products arising from combustion of the sample in an atmosphere of oxygen. Combustion is carried out in a specially designed bomb and the products are passed through a column of dodecyl phthalate on diatomaceous earth, using oxygen as carrier gas, when carbon dioxide and water separate. Benzoic acid was used to calibrate the experiment and three separate samplings of gas were taken from each combustion. The type of chromatogram obtained is shown in Fig. 2. Results obtained for five organic compounds showed quite good precision although the standard deviation for carbon determinations was only about half as good as that obtained with the classical Pregl method. Some workers are now applying the flask combustion method to the determination of carbon. The sample is ignited in the usual way and the carbon dioxide is precipitated as barium carbonate which is subsequently dissolved in an excess of acid. The presence of nitrogen and halogens offers no interference and it is suggested that the method may be developed for the determination of hydrogen as well. A specially constructed flask arranged for electrical ignition was used and this is described in detail by Cheng and Smullin.¹²

Thiols. Saville¹³ has proposed a simple titration of thiols, based on their reaction with silver nitrate dissolved in aqueous pyridine. The pyridinium nitrate which is formed is then titrated with standard alkali to a phenolphthalein end-point. Weakly acidic substances, mainly phenols, have been titrated photometrically with tetrabutylammonium hydroxide in a medium of isopropyl alcohol.¹⁴ In favourable cases the method is capable of differentiating as many as four phenolic substances in admixture, for example diphenyl phosphate, 2:4-dinitrophenol, *p*-nitrophenol and *m*-nitrophenol each gave distinct steps when they were titrated together. In most of the mixtures titrated the phenols were present in roughly equal amounts; results become more uncertain if one of the components is present in a large excess.

Formaldehyde. The chromotropic acid method for the determination of formaldehyde has been

adapted to the assessment of surface-active agents of the Span (Sorbitan fatty acid derivatives) type.¹⁵ The Span is first saponified and the sorbitol released is then oxidised with periodate to give a quantitative liberation of formaldehyde. This is then treated with chromotropic acid in the usual manner to give a colour intensity which is proportional to the Span present. The method was found to be applicable in the presence of anionic surface-active agents, but is invalidated when cationic agents are present.

Chloral hydrate. A colorimetric method has been described for the determination of chloral hydrate based on reaction with quinaldine ethiodide.¹⁶ In alkaline solution this reagent reacts with chloral hydrate to produce a blue cyanine dye. Chloroform, trichloroacetic acid and formic acid do not react under the conditions described. The authors have quoted results on a number of pharmaceutical preparations in which it is shown that they obtained good agreement between the colorimetric and official procedures.

A colour of satisfactory extinction value is produced when about 50 μ g. of chloral hydrate is present.

Nitrates. A new method for determination of nitrates has been proposed by West and Lyles¹⁷ and depends upon the reaction with chromotropic acid in sulphuric acid to give a yellow colour which is measured at 357 $m\mu$. The method can be used for solutions containing up to 5 p.p.m. of nitrate. Bromate, bromide, chlorate and titanous and titanous ions interfere seriously. Ammonium salts may be determined in the presence of volatile amines by precipitation with sodium cobaltinitrite in an acetate buffer followed by distillation of ammonia from the separated and washed precipitate.¹⁸ Hydrazine and substituted derivatives may be determined by automatic coulometric titration using electrolytically generated bromine.¹⁹ The method is best applied in the 3 to 5 mg. range when a standard deviation of about 1% is claimed.

Drugs and pharmaceuticals

Separation of organic bases.

Alginic acid has been proposed as a carboxylic cation-exchange medium for the quantitative separation of organic bases from solution.²⁰ The alginic acid must first be treated

so as to prevent gel formation in use and this is done by heating the acid with formaldehyde solution at 80° for 8 hr. and then drying. Material prepared in this way does not form a gel when moistened and is practically insoluble in water. Organic bases are adsorbed from aqueous solutions of their salts in a quantitative manner. The authors claim excellent recoveries of a wide range of substances including adrenaline, atropine, cocaine, codeine, morphine (and several of its derivatives), methylamphetamine, procaine and strychnine. Examples are given of the application of this technique to the determination of codeine in compound tablets containing codeine phosphate and to the determination of strychnine and brucine in preparations of nuxvomica.

Theophylline and caffeine.

Methods for the colorimetric determination of theophylline and caffeine have been examined and improved by Bontemps.²² For theophylline a 0.1 mg. portion in a borate buffer is treated with 2:6-dichloro-*p*-benzoquinone-4-chlorimine and the blue colour which forms on standing is extracted with amyl alcohol and measured at the wavelength of maximum absorption (about 602 $m\mu$). Caffeine is determined by treating about 25 μ g. in aqueous pyridine solution with sodium hypochlorite, followed by sodium thiosulphate and sodium hydroxide at timed intervals. The extinction is then measured at 460 $m\mu$.

Vitamin A. A new approach to the determination of vitamin A in pharmaceutical preparations has been suggested by Tardiff.²³ Hexane, which is more selective than either isopropyl alcohol or ether, is used as the extracting solvent. Spectrophotometric measurements are made at 325 $m\mu$ both before and after destruction of the vitamin A. Destruction is carried out by shaking the hexane extract with 60% sulphuric acid. This "hexane-destruction" method was applied to a number of multi-vitamin preparations and also to cod liver oil to which known amounts of vitamin A standard had been added. Statistical analysis of the results obtained showed a greater accuracy than was obtainable when the Morton-Stubbs method was applied.

Santonin. A colorimetric method has been suggested for the determination of santonin in artemisia

based upon the formation of a ferric hydroxamate derivative.²⁴ The lactone ring of santonin is first split by treatment with alkaline hydroxylamine which gives rise to the formation of a hydroxamic acid and subsequently a coloured derivative on addition of ferric chloride. Results obtained when the method was applied to a number of samples of artemisia are in very close agreement with those obtained by the volumetric and gravimetric procedures, while the precision of the results is about as good as that of the gravimetric and superior to that of the volumetric.

Reineckates. The reaction of organic bases with ammonium reineckate has been used for the identification and determination of many compounds of pharmaceutical importance.²⁵ Detailed information on the physico-chemical characteristics of a large number of reineckates has been collated and a method of quantitative determination has been described and discussed.

Sulphur. The versatile oxygen-flask combustion technique has again been applied to pharmaceutical compounds and preparations, this time to those containing sulphur.²⁶ Two methods of titration were used, the first, an alkalimetric procedure, being applicable only for samples which, on combustion, do not yield acidic or basic products other than sulphuric acid. The second method, more generally applicable, was the barium perchlorate procedure described by Fritz and Yamamura.²⁷ Application of the procedure to a wide range of products, including lozenges and complex sulphur ointments, is described.

Fixed and essential oils

Bergamot. A paper dealing with the evaluation of bergamot oil²⁸ illustrates what advances have been made in recent years in the assessment of volatile oils. Ultra-violet and infra-red measurements together with gas chromatographic data have been used in conjunction with each other as a means of detecting additions to natural bergamot oil. Genuine oil exhibits ultra-violet absorption maxima at 270 $m\mu$ and 312.5 $m\mu$, the extinction values being directly proportional to the concentration of bergaptenes so that dilution of the oil is indicated if values are low. In the infra-red spectrum the ratio of absorption at 12.00 μ to that at 12.52 μ is fairly constant and a lowering of the ratio

indicates added terpenes. Gas chromatograms of the natural oil are characteristic and the percentage area of peaks indicative of α -pinene, α -limonene, linalool and linalyl acetate are reasonably constant.

Eucalyptol may be determined by standing with a solution of hydrogen bromide in acetic acid for at least 40 hr.²⁹ The excess hydrogen bromide is then determined by titration with a solution of sodium acetate using methyl violet as indicator. Quantitative recovery of eucalyptol in the presence of menthol, thymol and camphor has been achieved, but when the method was applied to eucalyptus oil, a result considerably higher than that given by the α -cresol method of the British Pharmacopœia was obtained, probably due to the presence of other unsaturated compounds.

The Halphen test applied to oils to detect contamination with cotton seed oil has been studied in the light of present-day knowledge.³⁰ The colour developed is due to the cyclopropane structure and a procedure has been proposed which is stated to give reproducible colour development. The method recommended describes precise conditions for heating the oil with the carbon disulphide-sulphur reagent and, after development of the colour in a medium of pyridine, the extinction of the solution is measured at 505 m μ , sterculic acid being used as the standard material. An accuracy of $\pm 10\%$ is claimed for this method, which is of particular interest since the cyclopropane configuration present in sterculic and related acids has been found to be toxic to non-ruminants.

Steroids

Corticoids. A paper chromatographic scheme for the identification and determination of corticoid-like steroids in biological fluids and pharmaceutical preparations has been described.³¹ For the separation of cortisone, hydrocortisone, prednisone, prednisolone, triamcinolone and dexamethasone, four solvent systems are used and spots are identified by ultra-violet light, tetrazolium blue or isonicotinic acid hydrazide. Quantitative determination is made by cutting out the spots, extracting and measuring the extinction in methanol, in sulphuric acid, or by treatment with tetrazolium blue: recoveries of about 90% are claimed.

Prednisolone. When prednisolone occurs in combination with a large excess of another drug such as acetylsalicylic acid, a very careful and lengthy separation procedure is required before either ultra-violet absorption measurements or reaction with a tetrazolium salt can be used for its determination. Duerr and Pappas³² have described a method based on the addition of sulphuric acid and ferric chloride to an alcoholic solution of prednisolone with measurement of the resulting colour at 525 m μ . They claim that this determination can be made on formulations of prednisolone without the need for prior removal of other ingredients such as acetylsalicylic acid, acetophenetidin, caffeine or hydroxyzine. Boon³³ has proposed a method using enzymatic hydrolysis for the determination of prednisolone phosphate in pharmaceutical preparations, the prednisolone being determined by ultra-violet spectrophotometry. The method has been successful for determination of prednisolone phosphate in preparations where a direct solvent extraction method has failed. The preparations for which it is particularly useful are those in which *p*-hydroxybenzoic acid esters may be present as a preservative. The freshly prepared material is satisfactorily determined by solvent extraction, but on storage some deposit of the preservative may occur, leaving a non-extractable ultra-violet absorbing substance which interferes with the subsequent prednisolone determination.

When ethinylœstradiol and methyltestosterone occur together in ratios of from 6:1 to 1:4 they may be determined by an ultra-violet absorption method.³⁴ The procedure used depends upon the fact that the spectrum of methyltestosterone in methanol is independent of pH, while that of ethinylœstradiol shows a shift of absorption maximum from 298 m μ in alkaline methanol to 281 m μ in acid methanol. The average error of the method is about 2%.

Considerable interest has been taken in the determination of selenium as a trace impurity in steroids. A method³⁵ has been suggested based upon initial destruction of the organic matter, using Raney nickel, followed by oxidation of the selenium to selenous acid with concentrated nitric acid. The selenous acid is then reacted with *o*-phenylenediamine hydrochloride and after adjustment to pH 2.5 the coloured 1:2:3-benzoselenodiazol is measured at 330 m μ in chloroform solution.

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Resins and varnishes. Schenectady-Midland Ltd. have issued three brochures dealing with their resins for emulsion polishes, wire enamels and insulating varnishes and resins for rubber compounding and rubber-based adhesives.

Measuring and Controlling Temperature

CONVENTIONAL AND ADVANCED INSTRUMENTS AND EQUIPMENT

By A. Linford, B.Sc., A.M.I.C.E., A.M.I.W.E

The requirements of industry, not least chemical manufacturing, have inspired the development of very advanced methods and instruments for measuring and controlling temperature. Here the author reviews solid and fluid expansion instruments and electrical instruments operated by a change in value of an electrical property, these types being of greatest importance in industry. He concludes with a discussion of automatic temperature control.

WHATEVER system of classifying industrial temperature measuring equipment is adopted, considerable overlap cannot be avoided. For any particular temperature range, more than one class of instrument is available, frequently with different forms of presentation, and the final selection therefore is influenced by such considerations as the nature of the application and capital cost.

For a brief survey, temperature measuring equipment may be divided into three main groups:

1. Instruments which depend for their operation on the change in length of a solid, or volume or pressure of a fluid.
2. Electrical instruments operated by a change in the value of an electrical property, *i.e.* change in resistance or electromotive force.
3. Instruments which measure radiation from hot substances.

The last group of instruments is not applicable to temperatures below 500°-600°C., and since temperatures consistently above this value are rarely encountered in the chemical industry, radiation pyrometers will not be considered here.

Instruments falling in group 1 may be subdivided into (a) solid expansion, (b) fluid-in-metal, and (c) liquid-in-glass thermometers, and of these the familiar liquid-in-glass system may be ignored, since in industrial work its scope is extremely limited. However, with the appropriate N.P.L. Certificate of Accuracy the mercury-in-glass thermometer does constitute a standard against which other temperature measuring systems are checked. Therefore it forms an essential item of test equipment.

1a. Solid expansion thermometers

The most usual form of solid expansion thermometer is the bi-metallic type, the detecting element consisting of two thin metal strips having widely different coefficients of thermal expansion, which are riveted or welded together. Under the influence of an increase in temperature the bi-metallic strip undergoes a change in curvature and, through a magnifying linkage, this movement is used to operate the presentation element which, in most instruments of this type, consists of a simple circular indicator. To obtain maximum sensitivity, the bi-metallic strip is usually coiled into a spiral. The overall temperature range of these instruments is -100°C. to +550°C., but industrially the range is limited to 0°C. to 400°C. For temperatures up to about 300°C., the bi-metallic strip consists of invar and brass, while for higher temperatures two nickel-iron alloys of different compositions are generally used.

The application of these instruments is strictly limited by the fact that the presentation element cannot be divorced from the detecting element, so that if used for recording purposes the maximum temperature which can be dealt with is of the order of 80°C. The accuracy of measurement is of the order of $\pm 5\%$ of the scale range, and the application is usually confined to gas temperature measurement.

1b. Fluid-in-metal thermometers

The exact type of thermometer is designated by the class of fluid used

as the filling medium, with an indication of the principle of operation. The three types are liquid expansion, constant gas volume and vapour pressure. In all these cases the mechanical details of construction are identical and these will be considered first.

The temperature sensitive element or bulb consists of a small cylinder sealed at one end, the other end being attached to a capillary tube which forms the connection between the bulb and the presentation element. The presentation element, essentially, is a pressure gauge, the indicating pointer and/or recording pen being actuated by Bourdon tube or similar element of the helix form.

A very wide variety of bulb shapes and sizes, fittings and pockets are available to suit all industrial applications, and there are various types of sheaths for the protection of the relatively delicate capillary tube.

The most common liquid expansion instrument in this class is the mercury-in-steel thermometer (Fig. 1). In this the system is completely filled with mercury at high pressure, so there are no errors due to changes in barometric pressure and no correction is required for difference in level between the bulb and the presentation element. Automatic compensation is provided for changes in temperature of the capillary tube and instrument.

These thermometers can be used for measuring the temperature of solids, liquids and gases over a range of 0° to 600°C., the accuracy of the registration being of the order of $\pm \frac{1}{2}\%$ of the scale span up to 300°C., and $\pm 1\%$ for temperatures

above this. The length of capillary may be up to 200 ft.

In the constant volume gas thermometer, which is generally limited to the measurement of liquid temperatures, the system is entirely filled with an inert gas such as nitrogen or helium. The pressure measuring element acts as a true pressure gauge and not as a volume measuring device, as in the liquid sealed systems.

The initial pressure of the gas is low, so that barometric pressure variations have some effect on the instrument reading. On the other hand, a low pressure enables a thin-walled bulb to be used, which results in quick response to temperature changes. There is no "head" error due to a difference in level between the bulb and the instrument.

The effect of temperature change of the capillary and instrument depends on the bulb temperature, the error decreasing with increase in bulb temperature. The error also decreases with increase in the differential range of the instrument. The error may be reduced by using a twin capillary system, but only one bulb, and two pressure measuring elements connected together differentially. The error is also reduced by making the volume of the system as small as possible in comparison with that of the bulb, a desirable figure being about 2% of the bulb volume.

By suitably proportioning bulb and capillary volumes, capillary lengths up to about 200 ft. can be used.

The overall temperature range of these instruments is -50° to $+500^{\circ}\text{C.}$, and an accuracy of $\pm 1\%$ of the scale range may be expected.

The vapour pressure thermometer can be used for measuring the temperature of solids, liquids and gases, and is the least expensive of this class of instrument.

The bulb is partially filled with a volatile liquid so that variations in bulb temperature result in corresponding variations in the pressure of the saturated vapour above the liquid. This pressure is transmitted through the capillary tube to the pressure measuring element in the instrument by means of either a column of superheated gas or condensed vapour, depending on whether the temperature of the capillary tube and instrument is above or below that of the bulb. This change from vapour to liquid state or *vice versa*, depending on

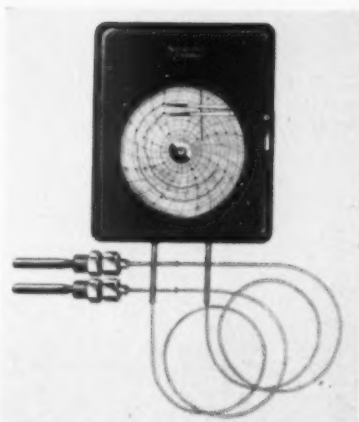


Fig. 1. Two point mercury-in-steel temperature recorder (Negretti and Zambra Ltd.)

the relative temperatures of the two portions of the system, results in an appreciable lag in measurement if, within the operational range, the bulb temperature changes from a point below to a point above the temperature of the capillary and instrument, and the reverse. In addition, sudden cooling of the bulb over this range will cause the indicating and/or recording mechanism movement to be interrupted by a series of kicks. It is therefore inadvisable to use vapour pressure thermometers under such conditions.

With regard to "head" correction, this may be necessary if the bulb is at a higher level than the instrument and at a higher temperature than the capillary and instrument.

In most instances, barometric pressure fluctuations have no appreciable effect on the accuracy of registration

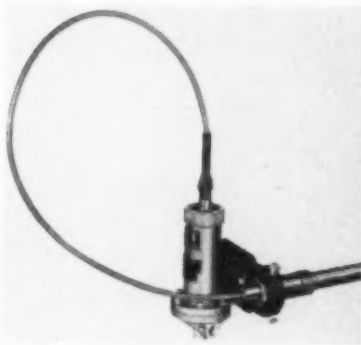


Fig. 2. Helium filled constant gas volume thermometer with pneumatic transmitter (Associated Electrical Industries Ltd., Instrumentation Division).

and neither do normal ambient temperature variations.

A characteristic of these thermometers is that, unlike the other systems described above, the temperature scale is not equally spaced but expands and becomes more uniform with increase in temperature—the exact scale spacing is influenced by the choice of the filling medium. This is an advantage in applications where it is important to measure over a wide range and read accurately at high temperatures.

Among the filling liquids used are methyl chloride (0° – 50°C.), ethyl chloride (30°C. – 100°C.) and toluene (150°C. – 250°C.). The normal industrial range is -20°C. to 350°C. , but vapour pressure thermometers are available for temperatures outside this range. The accuracy to be expected is about $\pm 1\%$ of the maximum reading at the upper end of the scale. Capillary tube lengths up to 200 ft. may be used.

By using a two pen instrument and two measuring systems, with any of the three systems described in the foregoing, two different temperatures can be registered on one instrument (see Fig. 1). Only practical considerations limit the total number which could be registered in this manner.

It is interesting to note that the mercury-in-steel system provides sufficient power to enable the Bourdon tubes to be connected differentially so that the difference of two temperatures can be registered.

Pneumatic transmission of temperature values

To meet the demand for standard pneumatic receiving instruments of the miniature form, for mounting on a control panel or in a control room, blind transmitters have been developed, which may be operated by the liquid and gas filled systems described in the foregoing.

The pressure responsive element normally mounted inside the measuring instrument is now used to actuate a conventional form of pneumatic force-balance transmitter which gives a 3 to 15 p.s.i. output pressure, 3 p.s.i. corresponding to the lowest required temperature reading and 15 p.s.i. to the maximum reading. The transmitter may form an integral part of the bulb system, or it may be connected to it by the required length of capillary tubing (Fig. 2).

In addition to the advantage of

measuring instrument standardisation, this transmission system provides a powerful output without imposing additional load on the measuring system.

A 3 to 15 p.s.i. air pressure related to temperature can also be obtained by fitting a conventional form of temperature indicator and/or recorder with a position-balance pneumatic transmitter.

2. Electric thermometers

These fall into two groups, (a) resistance thermometers and (b) thermo-electric pyrometers. They are suitable for measuring the temperature of solids, liquids and gases and cover the whole range of normal industrial temperature measuring requirements, *i.e.* $-240^{\circ}\text{C}.$ to $+1,450^{\circ}\text{C}.$

2a. Resistance thermometers

These, sometimes referred to as distance thermometers, utilise the well-known principle that the resistance of most metal conductors to the passage of an electric current increases with temperature. Thus, a temperature-sensitive element of this type consists of a coil of thin wire having a known resistance/temperature characteristic which is wound on a former and located in a protecting sheath or pocket.

The simplest resistance thermometer system consists of a Wheatstone bridge circuit, one of the four resistances of which is formed by the temperature detecting element. The bridge is energised by a d.c. source and the electrical out-of-balance is detected by a moving coil instrument, this indicating the out-of-balance in terms of temperature. With this system a constant voltage is essential, but automatic compensation for voltage variations can be obtained by using a measuring instrument of the cross-coil form.

Since the power to operate the instrument is very low, direct deflection instruments of this form are generally of the indicating only pattern. However, for recording, a mechanically operated "type-writer" principle may be employed, the record obtained being in the form of dots.

More sophisticated instruments are of the null balance form. These give an extremely powerful output, yet impose a minute load on the measuring system. In a typical design, a galvanometer detects the out-of-balance and, via an electro-

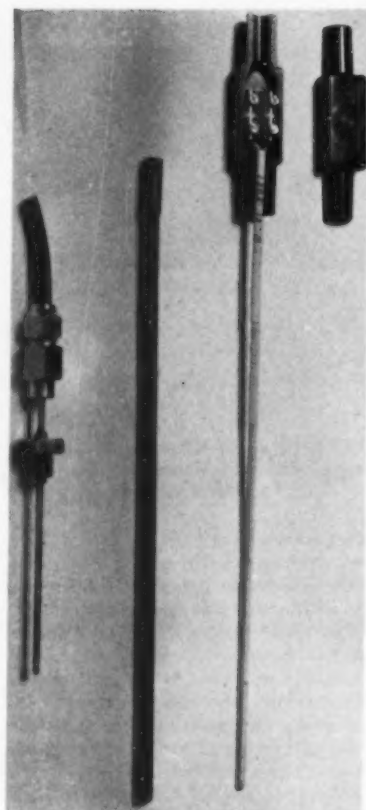


Fig. 3. Thermocouple assembly with refractory insulation and laboratory type head and, left, resistance thermometer assembly (Foster Instrument Co. Ltd.).

mechanical servo system, continuously adjusts the resistances of the bridge system so as to bring the galvanometer needle back to its central, null, position. The adjustment consists of moving a contact arm over a slidewire, the displacement of the contact arm from its datum position being a measure of the temperature. This movement is used to drive the presentation element. This system is insensitive to voltage variations.

To an ever greater extent, electromechanical null-balance instruments are being replaced by those employing electronic circuits. In principle, the out-of-balance, *i.e.* error signal, is fed into an electronic amplifier, the output from which is applied to a reversible servo motor which continuously moves the contact arm over a slidewire in the direction required to reduce the error signal to zero.

In an alternative form of null balance system no slidewire is employed, the servo motor being

driven by an electric force-balance system. Some designs of null-balance electrical systems are fully transistorised, *i.e.* do not employ the conventional electronic valves, and they can be operated from a low voltage, *e.g.* 12 volt d.c. supply derived from batteries.

Among the advantages of electronic instruments are speed of operation, *e.g.* 1 sec. for full-scale deflection and the minimum of mechanical parts.

The bridge circuit is contained in the instrument, the remote temperature sensitive element being connected to this by two electric leads. To compensate for changes in the lead resistance due to ambient temperature fluctuations—and such changes may be comparatively large if a long distance is involved—three or four lead circuits are employed. To avoid the introduction of variable resistances, the circuit should have the minimum of contacts, *i.e.* junction boxes, plug connectors and cable joints should be reduced to a minimum.

Nickel and platinum are the more usual metals used for the resistance elements, the former being suitable for temperatures up to $300^{\circ}\text{C}.$, and the latter up to $540^{\circ}\text{C}.$ An element is generally specified in terms of its "fundamental interval," *i.e.* difference in resistance between $100^{\circ}\text{C}.$ and $0^{\circ}\text{C}.$

A recent development is the thermistor, a compound of manganese, nickel, cobalt, uranium and other oxides blended to give the required resistance/temperature characteristics. They are very small in size and are usually shaped in the form of a bead or a rod. They have a negative resistance/temperature coefficient which is very much larger than that of metals usually used for resistance thermometers.

Their disadvantage lies in the fact that the temperature/resistance characteristic has a logarithmic form which cannot be predicted. Therefore individual calibration is required.

2b. Thermo-electric pyrometers.

This system utilises a thermocouple as the temperature sensing element. In principle, a thermocouple consists of two wires of different metals joined together at their ends to form a loop. When one junction is heated, an e.m.f. is generated which causes a flow of current round the loop. The magnitude of the e.m.f. is proportional to the difference in tempera-

ture between the hot and cold junctions.

The simplest form of thermoelectric pyrometer consists of a direct deflection instrument wired into the thermocouple loop. Since the measurement is one of temperature difference, either a constant cold junction temperature must be maintained or automatic temperature compensation must be provided. Both these methods are used.

The thermocouple proper is contained in a sheath terminating at its outer end in a terminal box. Two leads of suitable alloys, referred to as "compensating cable," are used to form the connection between the head of the thermocouple and the instrument. These leads are selected to have the required temperature/e.m.f. characteristic over the relatively narrow band of temperature variation to which they would be subjected.

To obtain a powerful response to temperature variations, the null balance form of instrument is recommended. The operation of these—of the electro-mechanical or electronic form—is as described in the foregoing, but in this instance a potentiometer circuit is used, in which the e.m.f. generated by the thermocouple is balanced against a constant e.m.f. generated in the instrument.

In the older forms of instruments dry batteries were used to produce the constant e.m.f., this e.m.f. being checked and adjusted at regular intervals by automatic reference against a standard cell. In modern null-balance instruments, electronic circuitry enables a constant e.m.f. to be maintained without the use of a battery and standard cell, the required power being derived from the mains. Automatic cold junction compensation is provided within the instrument.

For the lower temperature ranges "base metal" thermocouples are used, *e.g.* iron/constantan (-200°C. to $+850^{\circ}\text{C.}$) and chromel/alumel (-200°C. to $+1,100^{\circ}\text{C.}$). For temperatures up to about $1,500^{\circ}\text{C.}$ "rare metal" couples, *i.e.* platinum-rhodium/platinum, are required.

In thermocouple work, especially when the thermocouples are of rare metal, particular care must be taken in the selection of the sheaths so as to avoid contamination. When high temperatures are involved, *i.e.* above 500°C. , and using rare metal thermocouples, a refractory sheath is recommended.



Fig. 4. Moving coil type electric temperature indicator with switches for manual selection of measuring point (Foster Instrument Co. Ltd.).

One of the disadvantages of thermocouples is that, unlike resistance thermometers, in accordance with the application, the temperature/e.m.f. characteristic tends to change with time, so that their accuracy has to be checked and they have to be replaced at intervals (Fig. 3).

A modern trend in the design of electrical temperature measuring equipment is to use transducers which convert the input into a standard output, say 0 to 10 ma. This output can then be applied to any of a wide range of standard electrical measuring instruments.

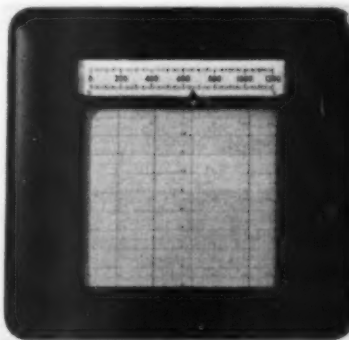


Fig. 5. Multipoint null-balance strip chart electronic temperature indicator/recorder. It can be employed with resistance thermometer or thermocouple (George Kent Ltd.).

An important advantage of electrical temperature measuring instruments is their extreme flexibility.

A large number of different temperatures can be recorded on one instrument of the null-balance form, which will automatically select and print the individual temperatures on a common chart (Fig. 4). The point cycle time may be as low as 5 sec. Alternatively, for indication, manual selection may be adopted (Fig. 5). The recorder or indicator may be located hundreds of feet away from the measuring points.

By suitable electric circuitry the algebraic sum or the average of two or more temperatures can be recorded.

In addition, there are no "head" errors or possible inaccuracies due to barometric pressure variations or breakage of capillary tubing, which latter, in the instance of fluid-filled systems, necessitates returning the equipment to the manufacturers for repair.

Other important features of electric temperature measuring equipment are that very small scale spans can be used and detecting elements can be made extremely small, thus obtaining a very rapid response to temperature variations.

The accuracy of measurement is of a high order, especially if rare metal resistance elements or thermocouples are used, *e.g.* to within $\pm\frac{1}{4}^{\circ}$ to $\pm\frac{1}{2}^{\circ}\text{C.}$ The accuracy of electronic null-balance instruments alone is of the order of $\pm\frac{1}{4}\%$ of full-scale range.

Automatic temperature control

The simplest form of control is that of the two-position (on/off) pattern, in which electric contacts are made or broken within the instrument according to whether the temperature is above or below the desired value. The "dead" zone between the contacts is readily adjustable, as is the desired value at which they are to operate (Fig. 6).

It may be pointed out that electronic circuitry enables physical contacts to be dispensed with, the necessary signal being derived, for example, by sensing the reversal of phase of the out-of-balance of an alternating e.m.f. as the temperature passes the balance point.

This simple control action, or variations of it, is quite suitable for many applications, *e.g.* maintaining vats at a constant temperature by opening and closing a steam supply valve in accordance with whether the temperature is below or above

the desired value. It will be appreciated, however, that on/off control always results in a certain amount of "hunting" of the temperature about a mean value.

For batch process work, automatic programme control is frequently of value. By means of a cam, cut to the required contour, and mounted in the measuring instrument where it is rotated at constant speed, the control contacts are continuously re-positioned in accordance with the predetermined programme (Fig. 6). The programming time can be adjusted over very wide limits.

For control to closer limits and in instances where plant characteristics render positional control unsuitable, the usual practice is to adopt pneumatic control. This may be of the proportional form, proportional plus integral, proportional plus derivative or a combination of all three.

With proportional only control, the exact desired value of the temperature can only be maintained at one particular set of operational conditions, any change, *e.g.* in loading, resulting in an offset. By using two or three-term control and correctly tuning this, very close control can be achieved, even under the most arduous conditions. The 3 to 15 p.s.i. output air pressure from the controller is applied to the appropriate form of pneumatic servo motor, such as a diaphragm unit for adjusting the position of the regulator, *e.g.* a steam or water valve.

Of course, programme control can be associated with pneumatic controlling systems.

At present the trend is towards the use of electronic controlling systems. For example, the output from the transducer, to which reference has been made in the foregoing, is fed into the controlling unit and the desired value is also expressed in electrical terms. The controlling unit senses the "error signal," *i.e.* the difference between the actual and desired temperature values, and amplifies and modifies this signal so as to give an electrical output which is related to the magnitude of the deviation, rate of deviation, and rate of change of deviation.

These controlling units are fully transistorised and employ printed circuitry, and if required they can be energised by a low voltage d.c. supply. They can be provided with indicators to show the value of the input, output and desired value.

It will be appreciated that these standard pneumatic and electronic



Fig. 6. Temperature programme controller fitted with electric contacts (Negretti and Zambra Ltd.).

controlling units can be applied to the control of any physical variable.

The design of electrically operated regulating units is still under development so, at present, it is the usual practice to convert the electrical output from these electronic controlling units into an air pressure for operating the regulator.

It is of interest to note that modern electronic controlling units can be used in inflammable areas.

This survey of temperature measurement and control would not be complete without some reference to the factors involved in making certain that the required temperature is actually being measured. In liquid temperature measuring applications, whenever possible the liquid should be in a state of turbulence and the pocket or sheath should be long enough to prevent conduction errors—the depth of immersion should be from 10 to 20 times the diameter of the sheath or pocket. To reduce measuring lag, the air space between the wall of the sheath or pocket and the detecting element should be as small as possible. When measuring the temperature in small pipes, the detecting element assembly should be inserted at a right-angle bend so as to obtain full immersion.

In the case of gas temperature measurement, in addition to the items mentioned above, radiation of cold surfaces "within sight" of the temperature sensitive element can result in errors. The heat loss from this cause can be reduced by using polished shields or accelerating the flow by aspiration.

NEW FACTORY FOR BRISTOL-MYERS

(Continued from page 217)

and automatically sealed. Junior aspirin have special snap caps to deter children from opening the bottles.

Collapsible tubes are filled in the normal manner, all filling, sealing and labelling being semi-automatic.

Mum rollette provides a special problem. Here a ring is forced over the neck of the bottle, a polystyrene marble is blown into the ring so that it is retained but free to rotate, and the bottle is finally capped. The marbles are ground on the premises, washed and sorted before being passed to the packing section.

Finally the bottles and tubes are labelled and packed in batches. They are moved to the main store where the orders are made up. Generally a month's supply of any one product is held in readiness, but this depends on the season, since deodorants are most used in hot weather and cough mixtures in winter.

Control laboratory

This supervises all raw materials and checks products during manufacture and finally when they are ready for distribution. Checks include a general chemical assay for all products and physical tests such as viscosity for liquid products and crushing for tablets. All products are shelf tested. This laboratory also deals with any customers' complaints or any new products that require investigation.

Boiler house

There are two low-pressure boilers and one high-pressure for the production of both process heat and heating for the factory generally. Automatic oil firing is used on which, it is claimed, a saving is made of £600 p.a.

Further expansion

Although the company's needs for the next few years are satisfied as far as manufacturing space is concerned, it seems likely that after five to ten years the present factory will be inadequate. Rather than extend it, it is felt a completely new site and design will be necessary; one idea is to build a factory with several storeys so that the production flow is from top to bottom, rather like the system employed in a large flour mill. This would bring the economics of gravity flow of materials into the process.

Book Reviews

Micro-Organisms as Allies

By C. L. Duddington. *Faber and Faber*. 1961. Pp. 256. 25s.

THE BELIEF is still held that technical matters, however complex, can be explained in essence to the "man in the street" using language free from scientific jargon. This may be true; but the difficulty is that only an Ancient Mariner can hold the man in the street to the bitter end. Perhaps it is fortunate for the layman that the cinema and television now afford a more painless means of acquiring smatterings of science.

Mr. Duddington's book is an attempt to give both layman and student a broad picture of industrial microbiology. It is well produced, well illustrated, carelessly indexed, and for the most part written in a pleasant and easy style. A vast bulk of information is presented, mostly with commendable accuracy—though it is startling to find (p. 239) that *Desulphovibrio* is described as fixing atmospheric nitrogen.

In the reviewer's opinion, however, the result is a somewhat unsatisfactory book, partly for reasons already given, and partly because of the patchy presentation of the material. The traditional yeast fermentations, e.g. for beer, wine and bread, are described at length in a readable manner. But one wonders at the inclusion of so much material that bears little relation to the title of the book. Chapter 3 on "The Yeasts of the Wine Vat," for example, is mainly taken up with the history of the wine industry, with insect pests and fungal diseases of the grape vine, and so forth.

An initial chapter gives a brief account of the nature of micro-organisms. More detailed facts about yeasts, moulds and bacteria are scattered throughout later chapters, and vary from a full description of mitosis and meiosis to the information that spore-staining of bacteria gives "a very pretty effect under the microscope." Incidentally (p. 166) the perfect stage of *Penicillium* has in fact been given a generic name, however unnecessary this seems.

Criticisms of the imperfections inherent in popular "outlines" should, one feels, be directed against publishers who demand such books

rather than against authors who struggle to achieve the impossible. This book will undoubtedly be found both interesting and useful by all beginners in microbiology and by those entering the fermentation industries. Whether at the same time many "laymen with no scientific knowledge" will succeed in reading it from cover to cover, only time will show.

L. D. GALLOWAY.

Pressurised Packaging (Aerosols)

By A. Herzka and J. Pickthall. 2nd edn. 1961. *Butterworth's Scientific Publications, London*. Pp. 509. Illustrated. 70s. net.

WHEN discussing the first edition (*Manufacturing Chemist*, 1959, **30**, (2), 81) I said: "This is the first textbook to be published on the subject." Because the commercial development of pressurised packs originated in the U.S., and was antedated many years by patents also issued in that country, it was surprising that the first textbook should appear in Great Britain. It is, perhaps, even more surprising that a further three years should have elapsed before the publication of such a book in the U.S.—almost simultaneously with the second edition of Herzka and Pickthall's work.

This second edition follows closely on the lines of the first, though considerable new material has been added—to the extent of some 100 additional pages. Opportunity has also been taken to revise certain passages and to correct errors. During the intervening years interest in compressed gases as propellants has increased; this is reflected by the inclusion of more information about them, and by the provision of additional formulations for use with

nitrogen as propellant. Included among the latter are some designed to deliver "quick breaking foams," i.e. foams that coalesce into liquids when disturbed.

Other new information includes: particulars of metal containers available in Great Britain, Germany, South Africa and the U.S.A. (pp. 97 to 99); the effect of composition on the suitability of ointment bases for use in aerosols (p. 297 *et seq.*); and an appendix (VI, p. 472) listing national organisations concerned with aerosols.

Two new chapters account for nearly half of the additional pages in the book. The first lists the regulations that apply (or are being considered for application) in several countries to the construction, manufacture and transport of pressurised packs. The presentation of this material in collected form should be useful to those concerned in the manufacture and sale of pressurised packs. The second new chapter lists "all patents dealing with pressurised packs which have come to our notice." It provides numbers, dates, subject titles and names of patentees. Besides being much more extensive, it will be more useful as a reference source than the Patent Index included in the first edition. Appendix V, listing the suppliers of aerosol component parts, and also contract fillers, in most of the important countries has been brought up to date and considerably extended.

The important pyrethrum synergist, *Bucarpolate*, has now been included in the chapter dealing with insecticides, and is duly indexed. However, it seems surprising that it is not also included in Appendix II, stated to list all the trade marks mentioned in the book.

Misprints are few, but the term "aerosolized medicaments" causes a shudder. It appeared also in the first edition, but one hopes it will not appear in the third!

The first edition was a most useful book. Most of its material, revised where necessary, appears in the second edition, along with enough new information to commend its purchase by anyone with an up-to-the-minute interest in the subject.

WM. MITCHELL.

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Danger of Coloured Pills

REFERENCE was made during a Lords debate last month (April) on accidents in the home to "the over-glamorisation of drugs."

Displaying a bottle, Lord Crook said it contained "coloured things that look like 'Smarties'." He went on: "There are 22 there, and every one capable of killing a child. I am well aware that there must be some differentiation of colours for the purpose of medical men who have to prescribe recognisable instruments of cure. But these glamour two- and three-colour drugs are not that at all." They were, he said, part of something about which peers had complained in the past—salesmanship.

Lord Crook explained that the pills were from 22 different bottles. "They have been provided by the British Pharmaceutical Society's Chief Inspector, who was glad to make them available because the Society is so worried." It was the attitude of mind of the mother which was important. The pills were properly prescribed, but the mothers would not get rid of them when they had finished taking the dose. The accumulation in the average medicine cupboard would "frighten the life" out of anyone.

"One of the great dangers is that people who have had an illness and found that the pink and blue pills did them good when they had that ailment, think that they have that ailment again and try to cure the thing they have not got by taking the pills again."

Replying for the Government, Lord Bathurst commented that the pills shown by Lord Crook were coloured for safety. He would ask the Home Secretary (Mr. R. A. Butler) his opinion about multi-coloured pills.

Drug prices and the prescription charge

By an "extraordinary coincidence" on March 1, the day that prescription charges increased to 2s., the 1s. 8½d. tube of *Bile Beans* laxative went up to 2s., pointed out Mr. Kenneth Robinson (Labour, St. Pancras, N.).

He said, during a Commons debate on medical prescriptions, that he was quite sure there was some connection, direct or indirect, between the new prescription charges and the in-

creased charge for the preparation.

We ought carefully to watch whether this happens with other similar preparations," he suggested to the Minister of Health, Mr. Enoch Powell. Mr. Robinson said manufacturers of proprietary drugs would feel that the public was conditioned to regarding 2s. as a sort of minimum figure for a drug supplied over the chemist's counter.

Mr. A. F. Holt (Liberal, Bolton, W) suggested to the Minister that since the antibiotic drug tetracycline was available in France at the equivalent price of £25 10s. per 1,000 tablets against the United Kingdom price of £58 per 1,000 tablets, he should encourage British hospitals to buy the drug in France and import it. Mr. Powell said he had no knowledge of supplies available in France at this price.

Bleach bottles

Domestic bleach, sodium hypochlorite, was sold in bottles similar to those used for beverages, without labels warning that it was dangerous to drink, stated Mr. Tom Driberg (Labour, Barking).

Mr. Dennis Vosper, Home Office Joint Under-Secretary, said that arrangements made by the Association of British Chemical Manufacturers were designed to prevent the use of bottles that might cause domestic bleach to be mistaken for beverage. No action on the part of the Home Secretary was necessary.

Tax on vet. medicines

A plea for the removal of Purchase Tax from veterinary medicines for farm animals was made by Sir James Duncan (National Liberal Conservative, South Angus). He cited, as examples, a tax of 4s. 10d. on a 30s. ½-gal. tin of terebene balsam, 6s. 5d. on a 35s. 2-gal. drum of foot-rot wash, and 6s. 6d. on a 40s. drum of fluke and worm drench, all of which were medicines for the treatment of sheep. Mr. Anthony Barber, Economic Secretary to the Treasury, replied that all the medicines referred to qualified for exemption if put up in a non-proprietary form.

Chemical spray dangers

Mr. Christopher Soames, Minister of Agriculture, Fisheries and Food,

said he was keeping closely in touch with the progress of surveys—one of which the Ministry itself was doing—into the deaths of wild birds presumed to have been caused by certain seed dressings. Widespread publicity had been arranged to encourage care in the use of these dressings. There would be a meeting with all the interests concerned after this spring to review the question.

When an M.P. questioned the Scottish Secretary of State about the deaths of large numbers of wild pigeons and other birds, Mr. John MacLay also referred to the investigations being carried out by the Agriculture Ministry which, he said, included feeding trials of the insecticides used in seed dressings.

Mr. Marples, Minister of Transport, assured M.P.'s that British Railways, when weed spraying on the railways, used only non-toxic sprays. A Member reported that 3,000 miles of railway embankment were shortly being sprayed by the Transport Commission.

SAFER AND BETTER COSMETICS

(Continued from page 216)

In this category there will be cosmetics with sustained action, similar to some drug preparations.

A specialised area of cosmetics that will expand is that of hypo-allergenic products. It has been estimated that over 15% of all women who use cosmetics (approximately 7 million in the U.S.) are allergic to some form of cosmetic. As increasing emphasis is placed on safety of use, more of these products will result.

Another new branch that may evolve is that of geriatric cosmetics. There are approximately 30 million people in the U.S. who are 55 or older; statistics show that there will be 45 million by 1980. Geriatric cosmetics will be specially formulated for elderly people to benefit ageing skin.

Finally, it is probable that the American male will be using cosmetics almost as much as his wife. The trend is already established and it is only a matter of time before treatment lines of cosmetics for men will appear on the market.

American Commentary

NEWS AND VIEWS OF THE U.S. PHARMACEUTICAL INDUSTRY by Rolf Silken

Food additives ★ Counterfeit drugs ★ Acetophenetidin (Phenacetin) under attack ★ Change in the NDA regulations ★ 1961's new drugs ★ Oral contraceptives ★ False claims for drugs and foods.

THE food additives regulations are now under discussion in the U.S.

What are food additives? It is said that they are the "key tools of food scientists" who have made it possible for Americans to have available over 6,000 food items, from Instant Mashed Potatoes to Lobster Newburg and tasty dessert mixes. Experts define them as "substances used in varied ways to make food better, safer and more abundant." But the federal, state and local authorities are needed to protect the consumers—man and animal alike—by means of laws and regulations, thus making sure that additives are safe.

Used in controlled amounts, *intentional* additives perform specific functions, such as preservation or flavouring. Additives are also needed to give certain foodstuffs the colour, texture and consistency wanted; e.g. certified dyes, emulsifiers and thickeners. Others control the food product's taste, i.e. acids, alkalies, sweetening agents, bleaching agents, spices, etc. There are also *incidental* additives, i.e. minute amounts of substances which become part of the food when applied as insecticides or fungicides to crops, or which may be absorbed or adsorbed from packaging material.

Federal legislation relating to food has existed in the U.S. since 1906. The basic law is the *Food, Drug, and Cosmetic (FD&C) Act* of 1938 with its three amendments: the *Miller Pesticide Amendment* of 1954 which establishes procedure for setting tolerances (safe amounts) of pesticides which may remain on fruits and vegetables; the *Food Additives Amendment* of 1958, requiring proof of safety before any substance may be added to a food; and the *Colour Additive Amendments* of 1960 which permit the use of colouring agents only if they have been proved to be safe: even large amounts must not induce cancer in laboratory animals.

The Government has accepted the food additives Extension Bill which gives the Food and Drug Administration (FDA) the right to

grant an extension of time for establishing safety of a food additive if a request was made on or before March 5, 1961; if action leading to safety determination was begun before March 6, 1960; if the FDA finds the extension necessary and without risk to public health; or, finally, if the food additive was in use before January 1, 1958. In no case can the extension be continued beyond June 30, 1964—40 months hence. This extension became necessary because the problems involved are much larger than the Congress and FDA realised in 1958.

Among the many hundreds of chemicals approved during the last 2½ years as food additives are 718 which are generally recognised as safe and 112 that are exempted because of prior sanction; among them are preservatives, buffers and neutralising agents, emulsifying agents, sweeteners, nutrients, sequestrants and stabilisers. Tolerances and/or restrictions have been established for many of these additives and for others (e.g. for anti-caking agents). Listed among the additives are also the spices and other natural seasonings and flavourings, essential oils, oleoresins and natural extractives. In addition, tolerances exist for many substances employed in the manufacture of food packaging materials, such as antioxidants, antimicrobics, driers and drying oils, plasticisers, release agents and stabilisers. Altogether more than 3,000 chemicals are at present undergoing investigations in the U.S.A. as to their safety when added to foodstuffs!

Feedstuffs are also affected by the Food Additive Amendment. The FD&C Act permits the authorities to consider feedstuffs as foods and, even worse, to declare all pharmaceutical preparations administered to animals orally or parenterally or locally as falling under both the drug and the food additives regulations if they are suspected of leaving detectable residues in meat, milk or eggs used for human consumption, or if they can produce cancer in man or (laboratory) animals when made

available in any quantity, regardless of the condition of the animal and the purpose of the drug administration.

Salts of the following six trace minerals widely used in animal feeds have just been exempted from the Food Additives Law, if used at "levels consistent with good feeding practice":

Cobalt (as acetate, carbonate, chloride, oxide, and sulphate);

Copper (as carbonate, chloride, gluconate, hydroxide, orthophosphate, oxide, pyrophosphate and sulphate);

Iodine (as Ca iodate, Ca iodebenate, cuprous iodide, 3,5-di-iodosalicylic-10 acid, ethylenediamine dihydriodide, K iodate, Na iodate and thymol iodide);

Iron (as ammonium citrate, carbonate, chloride, gluconate, oxide, phosphate, pyrophosphate, sulphate and reduced Fe);

Manganese (as acetate, carbonate, citrate, chloride, gluconate, orthophosphate, phosphate, sulphate and manganous oxide); and

Zinc (as acetate, carbonate, chloride, oxide and sulphate).

Drug counterfeiting

This is again in the news. The FDA declared its recent investigation proved that counterfeiting is not a great public health problem now, but could become one if not stamped out completely and speedily. In a national survey early in 1961 which lasted eight weeks, FDA officers discovered in nine drug stores nine counterfeit drugs among almost 2,700 samples (only 0.33%) which were checked in 900 drug stores; in another survey undertaken last year the situation was worse—59 counterfeits were found in slightly more than 1,000 samples (6%) obtained from 250 stores. In the 1,150 drug stores investigated the FDA men searched for the same six drugs, namely *Diuril*, *Equanil*, *Hydrodiuril*, *Meticorten*, *Miltown* and *Serpasil*. These were selected since they were known to be frequently counterfeited (because of large sales

volumes and high retail prices). The counterfeiters did a pretty good duplicating job—only 2.2% of the analysed samples were as much as 27% below labelled strength, but 82.4% showed full potency. The FDA plans an extensive drive to stop the bootlegging operation which depends on the collaboration of retail pharmacists.

Phenacetin hazards

Acetophenetidin, also known as phenacetin, has been declared a dangerous drug, probably because of its contaminant, acetic-4-chloronilide, which occurs even in the purest grades of both the European and American bulk material. Till now, it was one of the most widely used analgesics, but new investigations showed that it is an unnecessary drug, particularly when combined—as is so often the case—with aspirin and caffeine. When taken in larger than 1 g. daily dosage it can cause serious blood and renal damages.

Most of the over-the-counter preparations containing this drug carry no label warnings against prolonged use, yet it has been estimated that about 3,000 million 1 g. doses of acetophenetidin are swallowed annually in the U.S.A. alone—enough to supply 100 million people for 1 month with 1 g. daily of the drug.

Medical Letters recently stated [Vol. 3, No. 6, pp. 21-22 (1961)] that acetophenetidin has "no analgesic or antipyretic superiority over aspirin" and that "equal milligram doses of these two drugs appear to have equal analgesic effect on headache and musculoskeletal pains, and approximately equal antipyretic effect . . ."

New drug applications

The regulations concerning New Drug Applications (NDA) were recently amended, after the industry (and particularly the manufacturers of pharmaceuticals for farm animals) convinced the FDA of the impossibility of complying with their original request for tremendously large amounts of often very expensive samples to be submitted whenever an NDA is being filed. The revised FDA regulation says that "the New Drug Branch or the Veterinary Medical Branch may, on request of the applicant or otherwise, waive the requirements . . . in whole or in part." Thus it is no longer necessary to supply large

bulk packages of medicated feeds or of early experimental batches. Together with the NDA, one has to send to the FDA four identical samples each of the dosage forms used in clinical investigations, the new drug components themselves, and the finished market packages.

New drugs

Among the basically new drugs marketed for the first time in 1961 are the following:

Mylaxen, or hexafluorenum bromide, a muscle relaxant (Irwin, Neisler).

Panzalone, or hemisuccinoxypregnenolone, a hormone (Doak).

Parnate, or tranlycypromine, a depressant (SKF).

Plegine, or phendimetrazine bitartrate, an appetite depressant (Ayers).

Silicide, or irradiate silver fluoride, a slimicide (Silico).

Tandearl, or oxyphenbutazone, an anti-inflammatory agent (Geigy).

Trophenium, or phenacyl homatropinium hydrochloride, a blood pressure regulator (Cyanamid).

Velban, an alkaloid of periwinkle, a cancer remedy (Lilly).

Undergoing clinical testing are at present a *methyl reserpate derivative* (Ciba) as sedative; a 2-(*beta*-hydroxyphenethylamino)-pyrimidine and one of its analogues (Irwin, Neisler) as relaxant; and *thio-tepa*, a N-mustard compound (Lederle), as anti-cancer drug used in combination with surgery.

Oral contraceptives

Various compounds are now being tested and encouraging results have already been reported in the literature. One of these experimental products is *WLN 18446* (of Sterling-Winthrop). *Enovid*, or norethynodrel (of Searle), and *Norlutin*, or norethindrone (of Parke, Davis)—previously mentioned in this column—have been marketed for other than contraceptive purposes for four years already and the possibility of contraceptive side-effects was clearly stated in the labelling of these hormones. *Enovid* is the first drug which—only recently—obtained NDA clearance for use as an oral contraceptive, after it was established in extensive clinical trials that a 5 mg. daily dosage is safe and effective. Now other firms are announcing that they too are working on this type of product development, e.g. Ortho and Syntex, both, leaders in the field of hormone research and production.

Fraudulent claims

False and misleading claims made for foods, drugs and cosmetics are published by the FDA regularly; they make interesting reading—and are warnings to those who may be tempted to do likewise. Here are a few examples of exaggerated claims taken from a recent report:

A *cosmetic cream* claims to "tranquillise the skin and correct all abnormal skin conditions resulting from emotional upsets, tension and fatigue."

A *food supplement*—a vitamin-mineral preparation—was said to be "effective for the prevention and treatment of allergies, arthritis, blindness, cancer . . . colds, constipation, coronary thrombosis . . . diabetes, diarrhoea . . . insomnia . . . weakness."

A multiple *vitamin* tablet alleged to prevent and treat "skin conditions, wrinkles, blemishes . . . produce complexion beauty . . . good health and glowing vitality."

A *vitamin E* capsule claimed to be "an effective treatment for sterility and . . . aid to reproduction."

A *lecithin* preparation said to "digest dietary fats, regulate and lower the cholesterol level of the blood . . . prevent heart diseases. . ."

A capsule containing queen bees' *royal jelly* was supposed to be "effective in killing disease-causing germs" and was represented as "an antibiotic like penicillin. . ."

And a pure *honey* product was accompanied by a book entitled "Folk Medicine," claiming honey to be "effective for the treatment of arthritis, digestive disorders . . . infectious disease . . . heart disease . . . sterility . . . hay fever . . . alcoholism" and a multitude of other conditions and ailments.

United Steel. The United Steel Companies Ltd. employ over 38,000 people and produce about one-eighth of the steel made in Britain. The chemical industry is one of their biggest customers; the alloy steels of one of the group—Samuel Fox—are well known. United Coke and Chemicals Co. Ltd. is another member of the group and among its products are anthracene, tar acids, pure benzene, toluene and naphthas. The many activities of United Steel are handsomely portrayed in a new, stiff bound book, printed in colour and gravure.

Plant and Equipment

►IMPRINTER FOR CODING

A new high-speed imprinter for placing code-dates or other short legends on the top of cans, jars, bottles and other basically cylindrical products has been produced by Mark-O-Print, Ltd.

The *TMT Markocoder* unit is self-powered and self-synchronising to operate at any rate up to 1,000 units/min. It accelerates and decelerates automatically to match flow and fits into a conveyor line at any convenient point. The imprinter is fully automatic and requires no attention during operation. It holds enough ink for a whole day's operation, and is designed for quick changeover of copy whenever required.

The machine is adjustable for different product sizes and can print surfaces recessed as much as $\frac{3}{8}$ in. Eight separate printing heads register imprints in the same spot on each succeeding product. A unique cam-activated mechanism automatically compensates for products of widely varying heights. It accommodates rubber type and instant drying fluid inks suitable for any surface—even cans with residual grease.

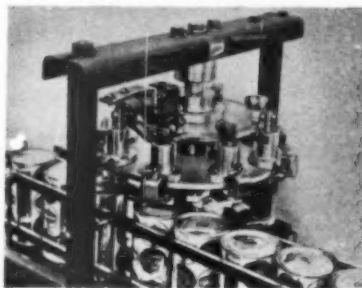
►NEUTRON GENERATOR

A source of neutrons of variable intensity and energy for use in the laboratory is provided by a new neutron generator. Its basic features are: high neutron output; experimental flexibility; continuous or pulsed operation.

The instrument employs a D.T. reaction to produce 14 MeV neutrons. The deuterium ions are accelerated on to a tritium target, and the neutron output under continuous operation is of the order of 10^{10} neutrons/sec. Fast neutrons can be moderated to produce thermal neutrons. The unit is continuously pumped and has an accelerating potential of 150 kV.

In addition the instrument can be quickly adapted to provide accelerated ion beams of deuterons or protons for other nuclear physics applications.

Another important application, in the analysis of high purity materials, is the use of the neutron generator to irradiate samples for radioactivation analysis techniques.



Fully automatic imprinter for cylindrical products will print up to 1,000 units/min. It is manufactured by Mark-O-Print Ltd.

►TEMPERATURE CONTROLLER

No moving parts are used in a temperature control system employing the Fielden *Bikini* temperature controller and a saturable core reactor.

The controllers give temperature control of circuits of up to at least 10 kW with no maintenance and an almost indefinite life, it is claimed.

The controller and saturable core reactor operate from a robust stainless steel measuring bulb of $\frac{1}{4}$ in. diameter. Two types are available, one for use at temperatures up to 500°C. and the other for temperatures up to 850°C. The controllers are available in 73 ranges covering temperature spans as short as 50°C. and as wide as 600°C. The control differential is only 0.5°C. and if desired the controller can be located as much as 300 ft. away from the measuring point.



Tablet hardness tester developed by Chas. Pfizer and Co. Inc. has a standard testing capacity of 35 lb.

►TESTING TABLET HARDNESS

A unique tester for determining the hardness of tablets, pellets and other caked or compressed materials has been developed by Chas. Pfizer and Co. Inc., U.S.A.

The tester resembles pliers with a dial gauge. As the sample is squeezed between two anvils the maximum pressure in pounds and kilograms is recorded. Most tests take less than 5 secs. A stop watch type indicator remains at the breaking reading until reset. Standard testing capacity is 35 lb. but higher ranges can be provided to order. The machine is supplied to industry by Testing Machines Inc., New York.

►CHROMATOGRAPHIC PROCESS CONTROL

About 40 intermediates are currently manufactured at the Castleford Works of Hickson and Welch Ltd. and most of these are based on nitration, chlorination, or reduction reactions with benzene, toluene and xylene. During these processes careful analysis is required and in many cases gas chromatography using the high sensitivity argon ionisation detection system has been found to be the only method giving a sufficiently high degree of accuracy and reproducibility. The part played by gas chromatography in process control may be illustrated by its application during the production of *ortho*- and *para*-nitrotoluene.

It is essential that the toluene used be of a high purity and in particular the amount of benzene present must be below 0.02%; all toluene to be processed is examined by gas chromatography, less than 0.01% of benzene being detectable. The mixed nitrotoluenes produced by nitration are fractionated and crystallised to produce *ortho*-, *para*- and *meta*-nitrotoluene. At all stages samples are taken for analysis in order to assess the efficiency of the operation. In the case of *ortho*-nitrotoluene traces of *meta*- and *para*-nitrotoluenes, nitro-benzene and non-nitratable materials can be detected when present at less than 0.05% of the total.

Hickson and Welch have installed a number of Pye Argon Chromatographs to provide accurate and reproducible analyses.

Wall chart for spotting contraries

Pernicious contrary-spotting can save money. For this reason the British Waste Paper Utilisation Council is aiming straight at the man-on-the-spot with its latest publication—an illustrated wall chart especially designed to be pinned up in salvage sheds, waste paper merchants' warehouses and other places where waste is sorted.

The illustrated chart, "Aids to Identify Waste Paper Unsuitable for Repulping," outlines four ways of tracing contrary materials such as wet strength agents, plastics and paraffin wax adhesives. The methods themselves are quick and practical.

The wall chart can be obtained free of charge from the Council's Secretary at 52 Mount Street, London, W.1.

Tapes, bags and labels

P. P. Payne and Sons Ltd. of Nottingham have developed a range of specialised packaging and labelling products.

Quikstrap banding tape is a flexible strapping tape produced from fibres strongly bonded together to provide a pliable strapping for cases, containers, cartons, parcels and packages of all types. It is applied with a simple precision built strapping tool which incorporates an easy to operate tensioning mechanism. The sealing jaws of the tool are carefully designed for the metal seals which are manufactured from bright galvanised steel.

A new improved portable dispenser is available with an automatic stop and over-run device for easy draw-off of the tape from the coil.

Rippatape self-sealing strapping tape has been specially produced for sealing and reinforcing where a very high tensile strength is required. It is ideal for bundling, sealing, identification and holding.

Rippatape tear-tape is supplied to manufacturers of solid and corrugated fibreboard cartons and containers to provide a reliable and speedy method for literally zipping open the cases. It is easily applied by container manufacturers to the inside of the container blank. The zip open action operates from an H or V-shaped slot positioned on one of the container walls. When the tab is lifted and a pull exerted, *Rippatape* tear-tape cleanly severs its way through the wall of the container along a line determined by the placement of the tape.

Payne's polythene bags are produced in varying sizes and can be supplied plain or printed in up to four colours. Bag sealing dispensers with sealing tapes are also available and are an economic method for sealing produce packed in polythene bags.

Jiffytab self-sealing price marking

labels in varied sizes are another well-known Payne product.

Satin and taffeta industrial ribbons enrich dressings for the sale of soaps, perfumes, cosmetics, etc. The ribbons are available in varying widths and gay colours.

These were some of the products on display at an exhibition Payne's put on at Bush House, London.

Coldsealing cuts costs

Samuel Jones and Co. Ltd. are soon to supply a variety of packaging materials coated with a substance that sticks only to itself, and then only when a predetermined pressure is applied.

Significance of this development, which stems from an agreement signed only a few weeks ago in Sweden, is that almost any package that is now heat-sealed can, in the not too distant future, be produced much more quickly. Packaging machines, too, will be cheaper to buy and to maintain, and far easier to use, since heat-sealing takes time, and heat-sealing equipment is expensive to install and requires careful control.

Cohesive materials, on the other hand, can be sealed as fast as their surfaces can be brought together, or as fast as the goods can be fed to the wrapping point.

Cohesive materials are odourless and non-toxic. They can be made to resist the passage of moisture-vapour or gases, or to permit the use of ethylene oxide



A variety of bottles are made by United Glass Ltd. This 10 gal. carboy is the largest glass container made in Britain by fully automatic process and the hundreds of 3½ c.c. vials are among the smallest.

for contents-sterilisation after packaging. They can also be formulated to withstand sterilisation by heat without affecting the reliability of the seal. Some kinds need heavy mechanical pressures to seal them together, but others seal with a finger-and-thumb pressure and can be repeatedly resealed by the consumer.

Spray-on starch

Liquid Mist "Reddi Starch" made by Simoniz (England) Ltd. and packed in a Metal Box aerosol is the first spray-on starch to be produced in this country. It is very simple to use.

The undamped article to be starched is laid on the ironing board, sprayed and ironed. If only cuffs and collars are to be stiffened it is simple to "mask out" the remainder of the garment.

Filled by the Aerosol Packaging Co., the pack is a standard Metal Box 8 oz. aerosol fitted with their Precision break-up spray-valve.

For the most efficient operation of the pack it is desirable to pull off and rinse the spray button of the valve after each day's use.

Although a far from simple product to package in aerosol form, the potential market for "spray on" starch appears to be considerable in this country. The growth of its use in America, where it has been on the market for one year, has been spectacular, rising from some 25m. units in 1960 to an estimated 50m. in 1961.



Spray-on starch pack in white, blue silver and red and fitted with a plastic cover.

Neither lackey nor scourge

The Health Minister explains his "middle course" policy to the managers of the drug industry

MAKING his debut as Minister of Health before the top management of the pharmaceutical industry at the annual dinner of the A.B.P.I., Mr. Enoch Powell said he was neither the industry's lackey nor scourge, but was pursuing a policy which was neither subservient nor inimical to the industry.

In an articulate and closely argued speech Mr. Powell said that though he was the only customer for about a third of the industry's output he did not believe he should try to control the supplier by making a take-over bid for him. His weakness was that he could not on financial grounds deny to a patient a particular proprietary drug on which his life might depend. The industry's weakness was dependence on the N.H.S. for virtually the whole home demand for ethicals. There should be a candid recognition that the best course for both was a straightforward customer-supplier relationship, the one side seeking a good bargain in its vast expenditures, the other looking to earn a good profit, in fair competition, and both believing that the public good was served by their respective efforts.

He rejected the argument that exports would suffer because of price regulation and prescribing checks. "The great export trades your industry has built up cannot depend either on the Health Service paying more than competitive prices for its drugs or upon prescribing being less than sound and economical."

Mr. Powell concluded a generally well received speech by praising the work of the A.B.P.I. as a practical channel of communication between customer and supplier.

Replying to the Minister, the president of the Association, Mr. H. W. Palmer, thanked him for a lucid and accurate analysis of the Ministry's and the industry's respective rôles in the N.H.S. It was about methods rather than principles that controversy arose. He declared flatly that the industry had to earn profits, but "many of us are as much concerned to make a worthwhile contribution to the solution of problems of public health." The industry was unhappy about being charged with responsibility for matters whose control was political and nothing to do with research and pharmaceutical enterprise.

British Hydrocarbon's S. Wales project

British Hydrocarbon Chemicals Ltd. have acquired several hundred acres of land at Baglan Bay, between Port Talbot and Neath, South Wales, and about a hundred acres of sand dunes have been cleared and levelled for initial development of a petrochemicals plant.

Following the Grangemouth pattern, the initial operations at the Baglan Bay Works will be based on a steam cracker, producing ethylene, propylene and butadiene from the resultant mixture of cracked gases. Further products are in the planning stage.

As feedstock, the plant will use a light petroleum distillate received from the BP Refinery at Llandarcy, some three miles distant.

Part of the ethylene will be transferred to another BHC plant on the same site where it will be combined with chlorine (which will be purchased from another source) to make ethylene dichloride, an intermediate used for the manufacture of vinyl chloride monomer which in turn is polymerised to PVC. This ethylene dichloride plant will be a duplicate of one now nearing completion at BHC's Grangemouth Works.

The remainder of the ethylene produced will be transferred to the new plant, for the manufacture of styrene monomer, being erected on the same site by Forth Chemicals Ltd., which is owned by British Hydrocarbon Chemicals Ltd. and Monsanto Chemicals Ltd.

Butadiene will be extracted and refined for sale for the manufacture of synthetic rubber and other copolymers. This will supplement BHC's production of butadiene at Grangemouth where one extraction plant has been in operation since 1956 and a second is due to be completed later this year.

Stockpile of oral polio vaccine for U.K.

Up to 100,000 doses of Sabin type oral polio vaccine will be held by the Wellcome Foundation as an emergency stock for the Ministry of Health. It will be stored at Dartford and Beckenham. News of the emergency stock was given by the Minister of Health in Parliament last month.

Wellcome are reserving stocks in view of requests for supplies from abroad. Oral vaccine is not yet used in Britain. Results of last year's M.R.C. trials are awaited.

I.F.F. to build new factory

International Flavors and Fragrances are to build a new U.K. headquarters at Enfield, Middlesex, near their present factory. The original buildings at Enfield have been extended from time to time to cope with expanding business, but since the recent merger of Polak and Schwarz and van Amerigen-Haebler saturation point has been reached.

The new site is some 3½ acres in extent. Building has commenced and completion is expected during the summer of 1962, when the present premises will be vacated and a complete transfer of the U.K. business, with exception of the aromatic chemical plant at Haverhill, Suffolk, will be made from the existing site.

The new plant will comprise separate flavour and perfumery factories each served by their own laboratory areas. Administration and sales departments will be housed in a central office block. The total floor space will be nearly twice that of the present plant and ample space will remain for future expansion.

Kestners' new works

Kestner Evaporator and Engineering Co. Ltd. are to transfer their London works from New Cross to Greenhithe. The new site covers 10 acres and is adjacent to the new Dartford Tunnel, so that direct access from and to the north can be made by by-passing London. The new works will gradually be brought into operation commencing in June and completing towards the end of the year. Among other items there will be an extensive new laboratory embodying facilities for pilot plant and experimental testing.

Control of medicines

The Association of British Pharmaceutical Industry has made recommendations to the working party appointed to review the legislative provisions relating to the control of medicinal substances. These include a threefold division of medicinal substances, a single Act to embody all legislation, and provision for the Minister to be advised by an expert body as to whether a substance should be classified as a poison or a substance which for medical or social reasons should be supplied only on prescription.

This is disclosed in the Association's annual report and year book, which points out that the total cost (manufacturers' prices) of drugs supplied to the N.H.S. was only 7.4% of total N.H.S. expenditure in 1959-60. Facts are given also about the increase of £1 million in research expenditure (to £6.25 million) and about exports—£44.3 million in 1960 against £40.9 million in 1959.

I.C.I. have doubled sales in ten years

In ten years, from 1951, I.C.I.'s assets, sales and profits have more than doubled. The 1960 annual report shows assets at £694.9 million compared with £307.4 million, sales at £558.4 million (£262.7 million) and profits before tax at £88 million (£40 million). But as a percentage of total funds invested profits are slightly lower than ten years ago—13.2% against 13.4%.

Reductions in selling prices and higher wages cut profits in the last six months of 1960, and though profits were good they "gave no more than an adequate return on capital." Price cuts cost about £5 million in profits. Principal products affected were *Alkathene*, fertilisers, and several basic chemicals such as chlorine, methanol and phenol.

Chlorine capacity was greatly increased and plants for making chlorinated paraffin wax, chlorobenzenes and chloromethanes were enlarged.

The number of employees in the U.K. increased from 109,596 to 113,699.

Exports. In 1960 they reached £96.6 million, 10% more than in 1959. I.C.I. overseas subsidiaries also increased their sales and these are now about equal to the exports of U.K. products. The Group's total overseas sales of £255 million now approach in value total home sales.

Terylene accounted for nearly half the year's exports, and compared with 1959 sales of the newer heavy organic chemicals were up by 53% and of pharmaceuticals by 23%.

The Commonwealth took £36.2 million of the Group's exports and is the biggest customer. But sales in the Common Market went up from £11 million to £13.9 million and to the EFTA from £11.3 million to £14 million. Sales to Russia went up from £3.4 to £5.5 million. Sales to the U.S. rose less, from £3.9 to £4 million.

Prescribing advice "discouraging" says ABPI

Criticism of the new Cohen committee report on prescribing has come from the Association of British Pharmaceutical Industry. The report (see *MANUFACTURING CHEMIST*, April, p. 185) says that doctors need not prescribe drugs and preparations other than those in the B.P., B.P.C. and B.N.F. together with drugs classified as N and P. If other drugs are prescribed the doctor might have to justify his action.

The A.B.P.I. says:

"This Report is most discouraging to those pharmaceutical manufacturers who carry out research and development and who make important contributions to our export trade.

"As we pointed out in the reservation made by two members of the Cohen Committee (Mr. J. C. Hanbury and Mr. D. E. Sparshott), the strength and prosperity of the industry depend upon the sale of branded goods of quality, whose

Capital expenditure. In the past two years money has been spent on relatively low cost plant modifications. Now the emphasis will again be on new and larger plants. Soon capital expenditure (£34 million in 1960) will return to the 1958 level of £45 million. Expenditure sanctioned but not spent at the end of 1960 totalled £45 million. Plastics, fibres and petrochemicals are getting the lion's share.

New products. In 1960 I.C.I. spent £15 million on research and development. Results include a new process for making synthesis gas for ammonia and methanol production, a new hard PVC foil, better dyes, a new veterinary anthelmintic, *Promintic*, and a non-arsenical spray for destroying potato haulms called *Reglone*.

Overseas companies. The outstanding development was the decision to build a petrochemicals complex in Rotterdam to get a manufacturing foothold in the Common Market. A new plastics plant will be built in Denmark.

African Explosives increased its sales and started up a 110,000 tons p.a. urea plant; a safety fuse plant should be ready in mid-1961. Sales and profits of Canadian Industries were higher and exports increased. "Duperial" Argentina is building plants for sulphuric acid, carbon bisulphide, hydrogen peroxide and phthalic anhydride.

I.C.I. of Australia and New Zealand pushed up sales by £A3 million to a record £A63 million. New plants for alkali, trichlorethylene car lacquers and pigments are being built.

Sales by I.C.I. (India) more than balanced the fall in sales of products exported by I.C.I. Other Indian subsidiaries are expanding production of paint, chlorine, polythene, explosives and vat dyes.

names and those of their manufacturers enjoy a world-wide reputation.

"The Hinchliffe Committee on Cost of Prescribing recommended that 'the conditions which favour profits for research, such as patent rights, publicising of proprietary names, and the price agreement with the Ministry of Health, should be accepted.' By implication, the restrictions on prescribing which doctors are now asked to accept cut across this recommendation. They can only result in slowing down the rate of therapeutic advance and in making this country increasingly dependent upon imported drugs."

Marchon in Moscow

Marchon Products Ltd., have taken a stand at the British Trade Fair in Moscow. They will display models of parts of the two fatty alcohol plants to be built in Russia, for which they have obtained a £3 million contract in association with Constructors John Brown.

Selling no job for "dogsbody"

"I sometimes wonder if the virtues and status of being a scientist: a technician: a production efficiency expert, etc., have all been over-boosted for many years relative to being a salesman. Too often in this and possibly other countries the belief is held that any 'dogsbody' can go on the commercial side. How wrong this is. We certainly need our full quota of scientists, technicians and the like, but we also need our full quota of people in the equally honourable and important profession of salesman."—Sir William MacFadzean in his retiring *Speech as President of the Federation of British Industries*.

CIBA reorganise U.K. interests

CIBA Ltd., Basle, have formed a company with an authorised share capital of £3 million under the name of CIBA United Kingdom Ltd.

This company will act as the holding company for the CIBA's U.K. interests by acquiring from CIBA, Basle, the issued share capital of its three wholly owned U.K. subsidiaries: CIBA Laboratories Ltd., Horsham, manufacturers of pharmaceutical products, CIBA Clayton Ltd., a company selling dyestuffs, and CIBA (A.R.L.) Ltd., manufacturers of synthetic resins and adhesives, together with the controlling interest held by CIBA Basle, in the Clayton Aniline Co. Ltd., manufacturers of dyestuffs.

Dr. R. Kappeli (Swiss) has been appointed chairman of CIBA United Kingdom Ltd., and Sir Arthur Vere Harvey, M.P., the managing director; Dr. A. Wilhelm (Swiss), Dr. A. Brunner (Swiss) and Sir Joseph Napier, Bt., have also joined the board.

Cyanamid develops European business

Further steps to develop its general chemicals business in Europe have been taken by Cyanamid International.

Mr. C. F. Bonnet, associate regional director for Europe, has been appointed managing director, with HQ at Zurich. Sales development and the general co-ordination of promotion, sales and technical services will be his main responsibilities. He will also act as liaison officer for Cyanamid subsidiaries and affiliates producing general chemicals in Europe.

Two other appointments announced are those of Mr. R. T. Novotny as manager marketing services, general chemicals, continental Europe, and Mr. L. Uytterelst as manager, finance and administration.

Waverley Gold Medal Essay

The Waverley Gold Medal, together with £100 will be awarded for the best essay of about 3,000 words describing a new project or practical development in pure or applied science. Further details and entry forms can be obtained from the Editor of *Research*, 88 Kingsway, London, W.C.2.

New directors and appointments at I.C.I.

Harold Smith, chairman of I.C.I.'s General Chemicals division for the past two years, has been appointed a director of I.C.I. He will take over as technical director from **Dr. Richard Beeching** in June when Dr. Beeching becomes chairman of the new British Transport Board.

Dr. James Craik, chairman of I.C.I. Nobel division since 1955, has retired and is succeeded by **Dr. John M. Holm**. **Dr. A. D. Lees** succeeds Dr. Holm as joint managing director and **Dr. J. Bell** has been appointed production director in his place. **J. A. Lofthouse** has been appointed to the board as engineering and technical director. **Dr. J. S. Flanders** is another new director, following **A. D. McLean** as the Division's home sales control and technical service director. Mr. McLean has joined the Heavy Organic Chemicals division as commercial director.

K. H. L. Cooper, commercial director of I.C.I. Billingham division, succeeds **J. W. Kerr**, who retires on May 31, as commercial managing director. **R. W. Pennock** has been appointed a Billingham division director and succeeds Mr. Cooper as commercial director.

St. John de H. Elstub has been appointed chairman of the Metals division in succession to **M. J. S. Clapham**, who has joined the company's main board as an overseas director in place of **Dr. J. S. Gourlay**. Dr. Gourlay has been made Group A director responsible for Alkali and General Chemical divisions.

John Platt, general works manager of **Kemball, Bishop and Co. Ltd.**, the fine chemicals division of the **Pfizer Group**, has been appointed general works manager for the **Pfizer Group**. He will be responsible for all production and engineering matters. Mr. Platt was for nine years chief chemist to the **Suffolk Chemical Co. Ltd.** at Ipswich, a subsidiary of **Reckitt and Colman Ltd.** From 1951 to 1954 he was works manager to the **Associated Ethyl Co. Ltd.** He joined **Pfizer Ltd.** as head of the recovery department of fermentation in 1954.

The directors of **Laporte Industries Ltd.** announce that **G. Hickson** and **Dr. F. S. Spring, F.R.S.**, have been appointed directors of **Howards and Sons Ltd.**

H. H. Woolveridge, a director of **The Distillers Co. Ltd.**, is the new president of the **British Plastics Federation**.



R. C. M. Dickson



T. F. A. Board

R. C. M. Dickson, a director of **Boots Pure Drug Co. Ltd.** since 1959, has been made retail director at the company's headquarters in Nottingham. **Henry J. Fraser** and **B. Jefferies** have been appointed to **Boots'** executive committee of management. All three men joined the company in their teens, Mr. Dickson and Mr. Fraser as apprentices at local branch shops, Mr. Jefferies as a trainee in the London warehouse.

Riker Laboratories Ltd. have made the following appointments: **E. A. Burfoot**, works director; **T. A. B. James**, administrative director; and **R. W. Richards**, sales director.

Two former directors of I.C.I. Lime division, **F. C. Covill** and **C. S. Hall**, have retired. When Lime division was absorbed into I.C.I. Alkali division last year both became Alkali division local directors at Buxton, former headquarters of the Lime division. Mr. Covill has been nearly 35 years with I.C.I. and its predecessors. Mr. Hall, who has retired after nearly 34 years' service with the company joined **Synthetic Ammonia and Nitrates Ltd.** in 1927.

Stafford Allen and Sons Ltd., London, N.1., have appointed **Owen J. Jones** as their London and Eastern area representative.

A. E. Newey has been appointed to the Technical Service department of **Hardman and Holden Ltd.** Formerly chief chemist of **E. Griffiths Hughes Ltd.**, he will be responsible for the technical aspects of the new chemicals produced by **Hardman and Holden** for the pharmaceutical and cosmetic industries.

R. I. Croft has been appointed advertising and promotion manager of **Armour Pharmaceutical Co. Ltd.**, Eastborne. He comes to **Armour** from **G. D. Searle** and previously was employed by **Smith Kline and French (Menley and James)**.

The Distillers Co. Ltd., announce that **William Reid** has retired and is succeeded as chairman of the Management Committee by **T. F. A. Board, C.B.E.** **H. H. Woolveridge** has been appointed a member of the Management Committee.

Mr. Reid has also resigned from a number of other offices and the following consequential appointments have been made:

P. H. Hogg to be chairman of **John Haig and Co. Ltd.**

W. D. Burnet to be chairman of **Scottish Malt Distillers Ltd.**

W. H. Greaves to be chairman of **Tanqueray Gordon and Co. Ltd.**

E. G. Gross, a director of **D.C.L.**, has been appointed resident director in charge of all the company's interest in Australia.

Ken Jackson has been appointed accident prevention officer for the **Pfizer Group**. Part of his job will be devising new safety procedures both in the **Sandwich** and **Folkestone** factories of the Group and also at the **Fine Chemicals Division** at **Bromley-by-Bow, London**. Mr. Jackson was formerly with **Associated Ethyl Co.** in **Cheshire** and with the **Alkali** division of **I.C.I.**

George Halek has been appointed works manager of **Kemball, Bishop and Co. Ltd.**, a member of the **Pfizer Group**. Previously he was head of organic production at the **Sandwich** plant of **Pfizer**.

C. D. W. Stafford has been appointed chairman of **Beecham Pharmaceuticals Ltd.** He is also chairman of **Beecham Research Laboratories Ltd.** and a director of **Beecham Group Ltd.**

Following the acceptance of holders of more than 90% of the shares of **W. J. Bush and Co. Ltd.**, of **Albright and Wilson Ltd.**'s offer to acquire the share capital of that company, **E. L. Bush**, chairman of **W. J. Bush Co. Ltd.**, has been appointed a director of **Albright and Wilson Ltd.**

Rudolph Frank, oldest serving medical representative of **Benger Laboratories Ltd.**, has retired. Born in **Prague** in 1891, Mr. Frank has had a varied and distinguished career. In 1938, holding the position of chairman of the **High War Economic Office** for pharmaceutical goods, he was forced to flee **Czechoslovakia** at the time of the German invasion. He came to this country almost penniless but possessing the know-how of many excellent pharmaceutical preparations. He joined **Benger** in 1943.

Thomas Armstrong has retired as managing director of Eli Lilly and Co. Ltd. He joined the parent company in the U.S.A. in 1933 and was appointed to the board of the British company on its formation in 1934.

Beecham Group Ltd. have appointed **Miss Philippa Lane**, formerly Group personnel controller, to the board of directors.

Ayrton, Saunders and Co. Ltd., Liverpool, have appointed **David S. Smith** works manager.

The appointment of **Dr. Norman A. C. Friend** as European technical manager, resident in the U.K., has been announced by Canadian Chemical Co. Ltd. of Montreal.

The Council of Scientific and Industrial Research has approved the appointment of **Dr. C. J. Jackson** to be chairman of the Water Pollution Research Board for the period April 1, 1961, to March 31, 1966. He succeeds **Dr. F. H. Garner**, who completed his term on March 31.

Dr. Jackson, who is the executive in charge of all water pollution problems for the Distillers Co. Ltd., both on the potable and industrial sides, was a member of the Water Pollution Research Board from 1956 to 1960. He is chairman of the trade effluent panel of the Federation of British Industries.

E. Etheridge, a member of the central technical office of Courtaulds Ltd., was appointed a member of the Research Board for four years from April 1, 1961.

T. J. Woodthorpe, works manager at Gosport, Hants, has been elected to the board of Cyanamid of Great Britain Ltd. He is 47 and has been in charge of the company's production facilities for seven years. He supervised the installation and start-up of a large-scale fermentation unit for antibiotic production and a general chemicals plant for producing melamine crystal. A biochemist, Mr. Woodthorpe worked in 1944 on the research and production of penicillin for the Wellcome Foundation.

R. A. Gregory, joint managing director of Midland Silicones Ltd., has been appointed to a new position with Albright and Wilson Ltd. He is to be head of a department in the process of formation, Inter-Company Planning, which will examine ways of improving the overall efficiency of the Albright and Wilson Group within the U.K. by inter-company co-operation. In a little over a year the Group has acquired A. Boake, Roberts and W. J. Bush and Co.

Dr. Gregory remains a director of Midland Silicones. **K. A. M. Barton** has assumed full responsibility as managing director of Midland Silicones Ltd.

F. V. Wells, consulting perfumer and editor of *Soap, Perfumery and Cosmetics*, has been awarded to Giuliana Brambilla Prix International d'Esthétique et de Cosmétologie, established by Etablissements Laserson et Sabetay. Dr. S. Sabetay comments "The choice of Mr. Wells will serve as an act of homage to the technical press, whose basic educative role deserves to be publicly recognised." We add our congratulations.

J. M. Baldock has joined the board of Ciba U.K. Ltd. Mr. Baldock was Conservative M.P. for the Harborough division of Leicestershire until 1959. He is chairman of Lenscrete Ltd., glass and ferro-concrete engineers, and takes an interest in several other companies.

After six years as assistant **H. J. Hann** has been appointed toilet buyer for Boots the Chemists. Mr. Hann, who is 34, joined the company in 1951 from Queen's College, Oxford, and after a period of training in various sections entered the sales department. He moved to the toilet buying office in 1955. **A. G. S. Wilkes** has been appointed photographic buyer.

The British Disinfectant Manufacturers' Association have elected the following officers and executive committee for 1961:

Chairman: S. L. Waide (Newton Chambers and Co. Ltd.).

Vice-Chairman: J. K. Wilson (Cooper McDougal and Robertson Ltd.).

Hon. Treasurer: V. G. Gibbs (William Pearson Ltd.).

D. E. Gatfield has been appointed sales manager of Vinatex Ltd. He is a graduate of London University and has been with Vinatex for four years.

Obituary

Sir Roger Duncalfe, former chairman and managing director of British Glues and Chemicals Ltd., died on April 15, aged 76. He was closely associated with Standards work and the B.S.I. for many years and in 1953 was president for three years. He was a former chairman and president of the Association of British Chemical Manufacturers and was for long active in the service of the Federation of British Industries, being one of its vice-presidents.

John V. Braddock, M.P.S., manager of Glaxo Laboratories bulk sales department, died recently. He was 55. Mr. Braddock joined Glaxo's staff at the age of 29. In his earlier days with the company he became well known in the north-east of England as a medical representative. He was a keen amateur photographer and a member of the Royal Photographic Society. His work was often shown at the Society's exhibitions.

MEETINGS

The Chemical Society

June 8. Reception and Conversation. 6.30 p.m. The Science Museum, South Kensington, London, S.W.7.

Institution of Chemical Engineers

May 30. Symposium on biochemical engineering. Royal Commonwealth Society, Northumberland Avenue, London, W.C.2.

Society of Instrument Technology

May 11. Control section A.G.M. 6.15 p.m. "Control mechanisms in the human nervous system," by W. Grey Walter. 7 p.m. Manson House, 26 Portland Place, London, W.1.

May 15. A.G.M. 6.45 p.m. "The thermocouple," by A. W. Foster. Nags Head, Jacksons Row, Manchester.

Institution of Plant Engineers

May 16. Works visit: I.C.I. Ltd., Paints division factory, Slough.

Society for Analytical Chemistry

May 12. "Automation in the analytical laboratory," joint meeting with Microchemistry Group. 7.15 p.m. Technical College, Nottingham.

June 9. Visit to the Biological Laboratories, Research and Standards Dept., Boots Pure Drug Co. Ltd., Nottingham.

Society of Chemical Industry

May 11. Visit to British Hydrocarbon Chemicals Ltd., Grangemouth.

May 17. "Computers in chemical process development," by R. V. Thomas. 5 p.m. Esso House, Abingdon, Berks.

May 26. A.G.M. Heavy Organic Chemicals Group. "Planning in the U.K. chemical industry," by M. A. Matthews. 6 p.m. 14 Belgrave Square, London, S.W.1.

May 30. The Hague. "Recent developments in the European plastics industry," by R. Gath. "The Six and its influence on the future of the European chemical industry." 9 a.m. Works visits. Annual Dinner.

May 31. The Hague. "Some aspects of the European chemical industry based on petroleum as a raw material," by H. Hoog. "Some trends in industrial pharmaceutical research," by M. Tausk. Works visits and reception, given by the Vereniging van de Nederlandsche Chemische Industrie.

June 1. Visit to Boots' Research Department.

British Pharmaceutical Conference

The 89th meeting of the British Pharmaceutical Conference will be held at Portsmouth and Southsea from September 18 to 22. Details are available from the Hon. Local Secretary, Norman L. Banks, 294 London Road, Portsmouth.

Company finance

Yardley and Co., have raised their final dividend by 5 to 27½% making the total ordinary dividend for 1960, 37½%. Group trading profits have expanded from £1,575,991 to £1,788,868. After charging tax of £911,465 (£789,856), net profit of Yardley is £732,425 against £624,601 previously.

£20,000 study of anti-rheumatism drugs

Although many drugs have beneficial effects in arthritis and in other forms of rheumatism, little is known about how they achieve their results. The Empire Rheumatism Council have announced that a grant of £20,000 has been made to establish a special research unit at King's College Hospital Medical School under the direction of Dr. M. J. H. Smith in order to find out how these drugs affect the cells of the human body.

The Council states: "If it is possible to establish clearly how certain drugs influence the activities of these cells, this will help in the eventual discovery of what causes the several types of rheumatism. A greater knowledge of the causes of the disease would enable more effective remedies to be devised."

"For the past three years the Council has made grants to support this branch of work and encouraging progress has been made in finding out how, for example, aspirin alters the chemistry of cells in the body."

Radioactive isotopes have been used for tracer work and it appears that aspirin can block at least two important chemical processes carried on by cells. This is of particular interest for, although aspirin has been used in rheumatism for over 80 years and is the most widely-used drug on earth, hardly anything is known about the way in which it acts.

The research unit is to extend this work to other types of anti-rheumatic drugs.

High pressures symposium

The S.C.I. are holding a symposium on the physics and chemistry of high pressures at Olympia, London, June 26-28, 1962, during the third congress of the European Federation of Chemical Engineering. The programme includes meetings on process optimisation, interaction between fluids and particles and the handling of solids.

The third congress of the European Federation will be held on the occasion of the second Chemical and Petroleum Engineering Exhibition, which will take place at Olympia from June 20-30.

The symposium will mark the retirement of Prof. D. M. Newitt from the Courtauld Chair of Chemical Engineering at Imperial College.

Suggestions for papers for inclusion in the programme are invited. Brief details should be sent to the General Secretary, S.C.I., 14 Belgrave Square, London, S.W.1.

Rentokil acquire Rodine manufacturers

Thomas Harley and Co. Ltd. of Perth have joined the Rentokil Group and their *Rodine* and *Modine* products will now be handled nationally by representatives of Rentokil Products Ltd.

Congress on chemistry and technology of fats

The 6th Congress of the International Society for Fat Research (I.S.F.) will be held in London from April 9 to 13, 1962. This will be the first occasion on which the Congress has visited England, previous meetings having been held in France, Italy, Spain, Austria and Poland.

The 6th Congress is being organised under the auspices of the Society of Chemical Industry (Oils and Fats Group) and the Congress President will be Dr. T. Malkin of Bristol University.

The programme will cover the following subjects, on which authorities are being invited to submit papers:

1. The chemistry of oils and fats, fatty acids and associated natural products.
2. New research techniques, including analytical methods.
3. Recent developments in the technology of oils and fats, including new processes, the utilisation of new raw materials, and the exploitation of new outlets.

The Congress Secretariat is at the Society of Chemical Industry, 14 Belgrave Square, London, S.W.1, and the Joint Organising Secretaries are Dr. F. Bradley and Dr. H. Jasperson.

Royal Society elections

A number of chemists were among the scientists recently elected Fellows of the Royal Society. They include:

Prof. James Baddiley, for his researches in organic and biochemistry, particularly in the field of co-enzymes, nucleotides and bacterial cell-wall constituents.

Dr. Joseph Chatt, for his work on the chemical and physical constitution of co-ordinated metallic compounds.

Mr. Christopher Frank Kearton, for his work on chemical engineering characteristics of volatile uranium products and for technological development in the textile industry.

Dr. Leo Marion, for his work in organic chemistry, particularly in the field of alkaloids.

Prof. Arnold Ashley Miles, for his contributions to bacteriology and for his work on the mechanism of inflammatory reactions.

Leda Pharmaceuticals

The name of Leda Chemicals Ltd. has been changed to Leda Pharmaceuticals Ltd. The company, which is a subsidiary of F. W. Berk and Co. Ltd., manufactures ethical products for the medical profession, mostly for the National Health Service, and Berk Optical Grade Zinc Bromide filling for radiotherapy windows. The filling allows perfect visual acuity and provides complete biological shielding. The company's plant is in Edmonton, London, N.18.

Leonard Hill Trophy

The spring meeting of the Golfing Society of the Institute of Incorporated Practitioners in Advertising was held on March 28 and was attended by a record number of players. The Leonard Hill Trophy for agencies competing was won by Mr. D. Taylor and Mr. W. E. Osborne of Osborne-Peacock. The Strong Challenge Trophy was won by Mr. A. Scott of Foster, Turner and Benson. The Leonard Hill Trophy, which is awarded by Mr. W. Leonard Hill, chairman of the proprietors of this journal, was presented to the winners by Mr. R. Nash, captain of the club.

The Glaxo story on film

"Glaxo in Britain" is a new 39 min. colour film telling the story of Glaxo Laboratories and its major products. The story is told in a conversation between a young man seeking information for a thesis on industrial development and a Glaxo executive. The executive's explanations mostly take the form of a commentary on scenes of research, development and production at Glaxo's laboratories and factories.

The film begins with the famous slogan of 1908 "Glaxo builds bonnie babies," and the narrator explains how the manufacture of infant food led the company into vitamins (and ultimately to vitamin B₁₂) and then, through bacteriology, to vaccines, including polio vaccine. The biggest leap forward was the manufacture of penicillin during the war; later streptomycin was added and then, as a result of the company's own research, the new antifungal antibiotic, griseofulvin. Now, of course, vitamin B₁₂ is also made by fermentation.

The final scenes deal with the manufacture of hydrocortisone from hecogenin in a complex series of 22 steps. This is the most technical sequence in the film. It serves, however, to emphasise Glaxo's heavy expenditure on research, which is now running at £1 million p.a. One in seven of Glaxo people are concerned with research, the narrator explains.

The company's overseas ramifications are also briefly outlined; two-thirds of the company's business is overseas. This point is underlined in the final shot, where the young man is introduced to a group of Glaxo people among whom are employees from overseas.

Chemical market research

A new and enlarged London office at 56 Hallam Street, London, W.1, has been opened by Roger Williams Technical and Economic Services Inc. This is an American firm of chemical and engineering economists whose speciality is chemical market research. The firm was started about ten years ago by Mr. Roger Williams, Jr., and it now has offices in New York, Princeton, Geneva, Toronto and London.

Amendments to British Pharmaceutical Codex

Page

PART I

78 BENETHAMINE PENICILLIN

Potency. Amend to: Not less than 1,008 Units per mg.

Assay for potency. Amend to: Dissolve about 0.05 g., accurately weighed, in 20 ml. of acetone (50%), dilute with sufficient sterile solution of standard pH 7.4 and determine the potency by the method of the British Pharmacopoeia for the biological assay of antibiotics, penicillin, using the Standard Preparation of penicillin. For the purpose of the assay and calculations, the stated potency is taken to be 1,090 Units per mg. The estimated potency is not less than 92.5% of the stated potency. The fiducial limits of error of the estimated potency ($P=0.95$) are not less than 80% and not more than 125% of the stated potency.

96 BISMUTH GLYCOLLYLSARANILATE

Content of Bi. Amend upper limit to 42.5%.

100 BISMUTH SUBNITRATE

Content of Bi. Amend lower limit to 70.0%.

124 CALCIUM GLYCEROPHOSPHATE

Clarity of solution. Amend 1.0 g. to 0.7 g.

237 DEXTROMETHORPHAN HYDROBROMIDE

Action and Uses. Amend the last sentence to: It is administered in tablets containing 15 milligrams or as a solution containing 15 milligrams in 5 millilitres.

599 POTASSIUM GLYCEROPHOSPHATE SOLUTION

Delete: *Weight per ml.* At 20°, 1.34 g. to 1.40 g.

715 SPERMACETI

Introductory paragraph. Amend the first two sentences to read: Spermaceti is a solid wax obtained from the mixed oils which are recovered from the head, blubber and carcase of the sperm whale *Physeter catodon* (*P. macrocephalus*) L. (Fam. Physeteridae) and the bottle-nosed whale, *Hyperoodon rostratus* Muller (Billberg) (Fam. Ziphiidae), which inhabit the Pacific, Atlantic and Indian Oceans.

Standard: Add the following:

Unsaponifiable matter. Not less than 48%.

Nickel. Boil gently 5.0 g. under a reflux condenser for 4 min. with 5 ml. of dilute sulphuric acid, filter while hot, cool the filtrate, add 0.3 ml. of a 1% w/v solution of dimethylglyoxime in alcohol (95%) and make just alkaline to litmus paper with dilute ammonia solution; no pink colour is produced.

Glycerol. To 10.0 g. add 40 ml. of alcoholic potassium hydroxide solution, and 60 ml. of alcohol (95%), boil under a reflux condenser for 30 min., cool, add 90 ml. of chloroform and 25 ml. of glacial acetic acid, transfer to a 1,000-ml. volumetric flask, and wash the flask and condenser with three successive portions, each of 25 ml., of water; to the combined solution and washings add 500 ml. of water, shake vigorously, dilute to 1,000 ml. with water, mix, and allow to separate; add 100 ml. of the aqueous layer to 50 ml. of N/10 periodic acid, allow to stand for 30 min. add 30 ml. of potassium iodide solution, allow to stand for 1 min., and titrate with N/10 sodium thiosulphate, adding starch mucilage when the titration is almost complete. Repeat the operation omitting the sample. The difference between the two titrations is not more than 5.0 ml.

720 STEARIC ACID

Introductory paragraph. Add: Stearic acid may contain a suitable antioxidant such as butylated hydroxytoluene 50 parts per million.

Add the following:

Labelling. The label on the container states the name and proportion of any added antioxidant.

PART VI

1028 MIXTURE OF AMMONIUM CHLORIDE

Content of ammonium chloride. Amend upper limit to 7.30%.

1029 MIXTURE OF AMMONIUM CHLORIDE AND MORPHINE

Content of ammonium bicarbonate. Amend lower limit to 1.11%.

Content of ammonium chloride. Amend upper limit to 2.50%.

1044 MIXTURE OF POTASSIUM BROMIDE

Amend "Anise Emulsion" to "Concentrated Anise Water." This amended formula is permissive until October 1, 1961, after which date the amended formula is obligatory.

1045 MIXTURE OF POTASSIUM BROMIDE AND CHLORAL

Assay for potassium bromide. Add "... using 3 ml. of sample and 30 ml. of N/10 silver nitrate."

Assay for chloral hydrate. Amend to: Determine by the method for Chloral Syrup, using 3 ml. of sample and 50 ml. of N/10 silver nitrate; each ml. of N/10 silver nitrate, after the volume required in the determination of potassium bromide has been deducted, is

equivalent to 0.005514 g. of $C_2H_3O_2Cl_3$.

1053 MIXTURE OF SUCCINYL-SULPHATHIAZOLE FOR INFANTS

Assay. Amend to: Dissolve about 5 g., accurately weighed, in 10 ml. of sodium hydroxide solution and heat on a water-bath for 2 hr.; cool, neutralise to litmus paper with hydrochloric acid, add 5 ml. of 5N hydrochloric acid and 75 ml. of water, and titrate with M/10 sodium nitrite determining the end-point electrometrically; each ml. of M/10 sodium nitrite is equivalent to 0.03554 g. of $C_{12}H_{13}O_5N_3S_2$. Determine the weight per ml. and calculate the proportion of $C_{12}H_{13}O_5N_3S_2$ weight in volume.

1054 MIXTURE OF SULPHADIMIDINE FOR INFANTS

The assay is unchanged, i.e. proceed as originally stated under Succinylsulphathiazole Mixture for Infants.

1087 COMPOUND EFFERVESCENT POWDER

Assay for sodium bicarbonate. Amend methyl red solution to phenolphthalein solution.

1107 Add the following:

SPIRIT OF ETHER; Ether Spirit; Spiritus = Aetheris; Sp. = Aether.

	Metric	Imperial
Anæsthetic Ether	330 ml.	3 fl. oz. 144 m.

Alcohol (90%)
to 1,000 ml. to 10fl. oz.

Standard

Weight per ml. At 20°, 0.796 to 0.800 g.

Alcohol content. 59 to 65% v/v of ethyl alcohol.

Dose. 1 to 4 millilitres (15 to 60 minims).

1114 SYRUP OF CHLORAL

Assay. Amend to: To about 0.6 g., accurately weighed, add 2.5 g. of zinc powder, 15 ml. of glacial acetic acid and 30 ml. of water, boil under a reflux condenser for 30 min., cool, filter through cotton wool, wash the residue with water, and to the combined filtrate and washings add 20 ml. of dilute nitric acid and 30 ml. of N/10 silver nitrate; shake vigorously, filter, wash the residue with water, and titrate the excess of silver nitrate in the combined filtrate and washings with N/10 ammonium thiocyanate using ferric ammonium sulphate as indicator; each ml. of N/10 silver nitrate is equivalent to 0.005514 g. of $C_2H_3O_2Cl_3$. Determine the weight per ml. and calculate the proportion of $C_2H_3O_2Cl_3$ weight in volume.

(Continued on opposite page)

New Products

Nail varnish remover

Handy Pads, circular pads impregnated with a new non-volatile solvent for the removal of nail varnish, have been introduced by the Charles Bedeman Research Organisation. They contain no acetone, no amyl-acetate, but *Purcellin*, a synthetic oil which is claimed to prevent the removal of natural fats from the nails and to stop brittleness and splitting. A single pad is claimed to remove several coats of varnish from both hands without smearing. The pads are packed in a quick-screw tin, price 3s. 3d.

Non-ionic surface active agents

Five new non-ionic surfactants are now being produced by Union Carbide International Co.

Three of the new surfactants—*Tergitol* non-ionics 12-P-6, 12-P-9 and 12-P-12—are based on dodecyl phenol. Two are based on trimethyl nonanol—*Tergitol* non-ionics TMN-3 and TMN-10.

Tergitol 12-P-6, 12-P-9 and 12-P-12 are dodecyl phenol adducts with 6, 9 and 12 mols of ethylene oxide respectively. The first is soluble in aromatic and aliphatic hydrocarbons and suitable for sulphation; the second is soluble in aromatic hydrocarbons and can be used in place of nonyl phenol adducts containing 5 to 8 mols of ethylene oxide; and the third is a general purpose non-ionic, completely water soluble.

Tergitol TMN-3 and TMN-10 are trimethyl nonanol adducts with 3 and 10 mols of ethylene oxide respectively. The first is soluble in aromatic hydrocarbons and slightly soluble in aliphatic hydrocarbons and mineral oil and the second, a general purpose surfactant, is also completely water soluble.

Anti-pruritic

Merck Sharp and Dohme Ltd. have released *Periactin* (cyproheptadine hydrochloride) for the treatment of allergic and pruritic conditions. The product is issued as 4 mg. tablets in bottles of 100, T.P. 16s. 6d., and 500, T.P. 75s., plus P.T.

(Continued from previous page)

1140 TABLETS OF FERROUS SULPHATE, COMPOUND

The change in the standard published in *The Pharmaceutical Journal*, January 21, 1961, p. 44, is permissive until October 1, 1961, after which date the amended standard is obligatory.

APPENDIXES

1232 DETERMINATION OF PROTAMINE SULPHATE

Heparin Solution. Amend 100 Units to 86 Units.



Free-running stearine beads manufactured by Price's (Bromborough) Ltd. which can be easily handled by pneumatic methods.

Pfizer's synthetic penicillin

A new synthetic penicillin, which is given orally, is claimed to be more effective than penicillin V and phenethicillin in streptococcal infections and against resistant staphylococci. It is α -phenoxypropyl penicillin (PA-248) and it has been produced by Pfizer Ltd. It is the subject of three papers in the *Lancet* of April 22 (p. 847 *et seq.*).

The molecular weight of PA-248 is 378.4 and it occurs as a mixture of two optically active isomers. The potassium salt, used in the experiments, is readily soluble in water and extremely stable in the presence of acid.

PA-248 is just as effective as the other two oral penicillins tested against sensitive staphylococci. It gave good results in five cases of pneumonia associated with penicillin-resistant staphylococci in the sputum.

Solvent reodoriser

Bouquet 31 has been formulated by Standard Synthetics Ltd. for use in the coating industry as a reodoriser which has a more distinctive perfume. The fresh smell is suitable for many products, especially floor polishes and coatings. The very concentrated odour is claimed to mask most of the unpleasant smelling new resin bases and solvents effectively.

Fluphenazine tranquilliser

A new tranquilliser, *Moditen*, will soon be available in the U.K. through E. R. Squibb and Sons Ltd. Under the generic name of Fluphenazine, it has already been approved by the U.S.

food and drug administration. It is prescribed for patients with anxiety and tension and for soothing sufferers from high blood pressure and from heart and circulatory ailments.

Stearine beads

Price's (Bromborough) Ltd. are now offering all grades of stearine in bead form. This includes both Price's *Pristerine* range and the *Stearex* grades marketed by Columbian International (G.B.) Ltd.

Stearine in bead form is ideal for bulk handling. The beads retain their free flowing characteristics under all normal conditions and may be conveyed pneumatically. They can be measured volumetrically and have less tendency to cake or dust than other physical forms.

Chloride-bromine steriliser

Diversey (U.K.) Ltd. have introduced a new steriliser in crystalline form, *Diversol BX*. This product has been approved by the Ministry of Agriculture, Fisheries and Food, and by the Ministry of Health, for use as an alternative to scalding in the cleaning of dairy equipment.

The compound is a combination of a stable sodium phosphate/sodium hypochlorite complex and a soluble bromide. It is claimed that the product has outstanding penetrating power, enabling it to cut through deposit films and assure instant kill of bacteria. Since it is a crystalline powder, it is easy to handle and risk of injury through spillage is avoided.

Diversol BX is stable and quickly and completely soluble. It also holds hard water salts in suspension and it drains and rinses freely, leaving no re-deposited salts in the form of film. Perhaps the most important advantage claimed for the product is its non-corrosiveness.

Diversol BX is recommended for use as a general steriliser in the food and beverage industries. Trial 50 lb. kegs are being offered over a period of three months to introduce the new product. It is normally packed in 325 lb. barrels and 125 lb. drums.

Appetite suppressor

A new product, *Plegine*, made by Ayerst Laboratories, New York, is claimed to have distinct advantages in curing obesity caused by excessive appetite. It is (*d*-3,4-dimethyl-2-phenylmorpholine)-bitartrate; its generic name is Phendimetrazine bitartrate. It is a white, odourless powder with a bitter taste; it is soluble in water, methanol and ethanol; its molecular weight is 341.

Plegine is claimed to firmly suppress the appetite, with a paucity of side effects and a virtual absence of CNS or cardiovascular complications.

News from Abroad

AUSTRALIA

Cobalt plant planned

Australian Cobalt Developments Ltd. is to establish a £100,000 cobalt-processing plant in Queensland—the first industry of its kind in Australia. It expects the plant to produce at least £500,000 worth of cobalt in its first three years of operation. The plant should start up in June or early July.

Million merger

A £1 million merger between Olins Industries Ltd. of Sydney and Blyth Chemicals Ltd. of Melbourne is announced. The two companies will be merged into an organisation to be known as Amalgamated Chemicals Ltd. Directors of both companies agree that amalgamation will achieve large savings in manufacturing and administration costs.

More naphthalene

Australian production of naphthalene and phthalic anhydride is to be increased under a £1,100,000 programme undertaken jointly by Broken Hill Proprietary and I.C.I. of Australia and New Zealand. B.H.P. is installing plant, at a cost of over £500,000, to process tars derived from coke ovens at Port Kembla.

FIJI

New drugs cure leprosy

With 131 leprosy sufferers being discharged as cured, 1959 was a record year in the fight against leprosy in Fiji, says the report of the Medical Department there. Nevertheless, it does not hold out any hope of the disease being eradicated in the near future.

The number of children being admitted with the disease is continuing to fall, and the fact that the proportion of tuberculous cases is increasing over the lepromatous seems to indicate that there is an increasing level of resistance to leprosy among the population.

Diamino-diphenyl-sulphone (D.D.S.) remained the standard treatment during the year under review, though two new drugs were tested, diethyl dithiolosulphthalate (*Etisul*), and a thiourea derivative known as DPT. The first, which is an oily liquid, has an offensive smell, and did not appear to exhibit in inhabitants of the South Pacific the effects claimed for it among Africans. The second appears to be as efficacious as DDS and further trials were commenced at the end of 1959. The number of patients in the leper centre on Makogai Island is now so small that clinical tests are becoming more difficult to arrange.

There were 317 patients at the centre at the end of the year, and the three

deaths during the year were the lowest number recorded in 12 months.

The money spent on public health continues to increase in Fiji. In 1950, when the population of the Territory was 293,764, expenditure ran at £1 7s. 2d. per head per year; by 1959, with a much larger population of 378,646, government was spending more than £900,000, or £2 4s. 2d. per head, on Medical and Health Services in Fiji. This represented 10% of the Colony's expenditure during the year.

INDIA

German assistance for intermediates plant

The Government of India will build a plant at Panvel in collaboration with the Germans for the manufacture of intermediates required for basic drugs, dyes and plastics.

Maharashtra State leads in basic drug manufacture, and in pharmaceutical processing it abounds in some of the most modern factories.

Some of the important projects for manufacture in Maharashtra in the Third Five-Year Plan are: penicillin, streptomycin, dihydrostreptomycin, chloramphenicol, tetracycline, chlorotetracycline, sulpha drugs, P.A.S. and salt, I.N.H., aspirin, sulphones, oral anti-diabetics, amodiaquin chiorqim (Camoquin), procaine HCl, Vitamin A, Vitamin B₁₂, Vitamin C, nicotinic acid and amide and emetine.

In this State there are over 250 firms manufacturing a wide range of pharmaceutical products. Of these, 85 firms manufacture biological and non-biological products, while the remaining manufacture only non-biological products.

Russians help build drug factories

Indian experts have visited Moscow to discuss plans for four plants which have been prepared by the Russians.

These plants, which will be publicly owned with Soviet financial and technical participation, will be situated at Rishikesh, Sanatnagar, Panvel and in Kerala.

The Rishikesh plant will produce antibiotics, the Sanatnagar plant synthetic drugs, the Kerala plant photochemicals, and the Panvel plant surgical instruments.

The antibiotic plant will have a rated annual capacity of 85 tons of penicillin, 95 tons of streptomycin and 100 tons of tetracycline. The synthetic drug plant's capacity will be 850 tons of intermediates, while the photochemical plant will produce 100 tons of medicines from indigenous herbs. The fourth factory will manufacture 2,500,000 surgical instruments annually.

The total estimated outlay of the four plants will be Rs. 30 crores (£ sterling 22,500,000). Of this, nearly a third will be foreign exchange, which will be provided by the Soviet Union through a special long-term credit.

ISRAEL

Formaldehyde plant

It is reported by Barclays Bank D.C.O. that formaldehyde will now be produced in Israel by a new subsidiary of the Atlit Salt Works. It will be used by the country's flourishing plastics, plywood and pharmaceutical industries.

SOUTH AFRICA

Anti-fertility pills

The demand for oral birth control tablets has been so great since they were introduced into South Africa in February that the manufacturers have been able to reduce the price by nearly 17%. Formerly a month's supply retailed at 30s. The new price is 25s.

Cerebos plant stopped

The Cerebos manufacturing group in Britain has postponed the building of a £100,000 factory in Southern Rhodesia. The reason for this decision is concern over the political situation and its effects on British business interests there. South Africa, on the other hand, is cited as a fine country for investment.

Beecham plant

The managing director of Beecham Overseas Ltd., who are establishing a £300,000 factory in Johannesburg for the manufacture of proprietary and ethical medicines, said that his organisation has a "lot of confidence" in South Africa. The factory will employ about 125 to 150 Europeans and 75 to 100 non-Europeans.

Oral polio vaccine

The Union Government is launching a national campaign to immunise about 6 million people in May against poliomyelitis, vaccinating every person at risk in the community, including African, Coloured, Asian and European. The oral vaccine which will be used is safe and apparently quite effective. It had been used in large-scale experiments in Mauritius, Kenya and South Africa.

Branding fluids

The South African Wool Textile Research Institute, Grahamstown, reports that work is continuing on scorable sheep branding fluids. Efforts are being made in co-operation with a branding fluid manufacturer to develop fluids which will dry quickly.

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Manufacturing Chemist—May, 1961



THE CHEMICAL MARKET

FEW CHANGES IN PRICES

LONDON.—The market has remained stable this month. Changes include **magnesium sulphate** which is up £2 to £17 ton, **lithium carbonate** is down 3d. to 4s. 10d. lb. and **silver nitrate** has also dropped 1½d. to 5s. 2d. **Palm kernel oil** is down £3 to £112 ton and **palm oil** is up £1 to £106 ton. New schedules for ethyl alcohol refer to 2,500 gal. bulk deliveries; synthetic grade is now 3s. per proof gal. and fermentation grade is now 3s. 9d. per proof gal. Methylated spirits, 64 o.p. and 74 o.p., have dropped to 6s. 11d. and 7s. 6d. respectively.

FINE CHEMICALS

Acetanilide 12½ kg.	7s. 4d. kg.
Arsenic trioxide 5 to 10-ton lots	£37 ton
Ascorbic acid 100 kg.	£3 6s. 6d. kg.
Aspirin 1-cwt. lots in bags 5-cwt.	4s. 10d. " 4s. 8d. "
Atropine Sulphate, 500 g. Alkaloid, 500 g.	£59 18s. 6d. kg. £68 15s. kg.
Benzene B.P.C. 28-lb. lots	1s. 8d. lb.
Benzoic acid 12½ kg.	7s. 4d. kg.
Benzyl benzoate 1-cwt. lots	4s. 11d. lb.
Bismuth oxide B.P.C. 1934 28-lb. lots	26s. 10d. lb.
Bismuth salts 1-cwt. lots: Carbonate Subgallate Salicylate Subnitrate	20s. lb. 19s. 3d. " 19s. 9d. " 18s. "
Borax B.P. Powder Extra fine	£60 ton £61 "
Boric acid B.P. Crystal Powder	£98 10s. " £96 "
Bromine B.P.C. 7-lb. lots	6s. lb.
Caffeine 50 kg.	42s. 6d. kg.
Calamine 50 kg.	4s. kg.
Calcium gluconate 1-cwt. lots dlvd.	3s. 7d. lb.
Calcium glycerophosphate 50 kg.	28s. 6d. kg.
Calcium lactate B.P. 28-lb. lots 1-cwt. lots	2s. 7d. lb. 2s. 4d. "
Chloral hydrate 50 kg.	10s. kg.
Citric acid B.P. Powder or granulated: 1-4 cwt. lots in bags 5-19 cwt. lots "	193s. cwt. 189s. "
Codeine Alkaloid 100 g. Phosphate 100 g.	£138 10s. kg. £110 "
Cream of tartar 1-cwt. lots 5-cwt. lots	£12 5s. cwt. £12 3s. "
Ephedrine Hydrochloride 3 kg. Alkaloid 3 kg. Sulphate 3 kg.	£7 1s. 1d. kg. £12 7s. " £7 1s. 1d. "
Eucalyptol 1-cwt. lots 5-cwt. lots	11s. lb. 10s. 6d. "
Ferri ammonium citrate B.P. 1-cwt. lots, scales 1-cwt. lots, granules	4s. 4½d. lb. 3s. 6½d. "

Ferrous gluconate B.P. 1-cwt. lots dlvd.	6s. 3d. lb.
Gallic acid B.P.C. 1-cwt. lots	10s. "
Gluconic acid technical 50% Minimum 12-gal. drums 19s. gal., drums extra, returnable	
Glucono delta lactone 1-ton lots dlvd.	5s. net lb.
Glycerophosphoric acid 24 litres	11s. 10d. litre
Glycine (amino acetic acid) 12½ kg.	18s. 10d. kg.
Hexyl resorcinol 10 kg.	£7 10s. "
Hydroquinone 12½ kg.	23s. 10d. "
Iodides Ethyl 4 kg. bottles Mercury, red B.P.C. 12½ kg. lots	66s. kg. 58s. 6d. "
Potassium B.P. 12½ kg. lots Sodium B.P. 12½ kg. lots	19s. 10d. " 24s. 9d. "
Iodine, Chilean crude, 99% min. in wooden casks	17s. 4d. kg.
Iodoform 12½ kg. and under 50 kg.	42s. 6d. kg.
Lactic acid Edible, 50% by weight Dark tech., 44% by weight	1s. 4½d. lb. 9d. "
Lactose 50 kg.	3s. 2d. kg.
Lithium salts Benzoate (5-cwt. lots) Carbonate (7 × 325 lb.) Chloride (7 × 300 lb.) Hydroxide (7 × 325 lb.) Citrate B.P.C. Sulphate Salicylate, 10 cwt., dlvd.	10s. lb. 4s. 10d. " 9s. 3d. " 6s. 6d. " 9s. " 8s. 6d. " 9s. 9d. "
Magnesium carbonate B.P. Light cwt. lots dlvd.	£129 ton
Magnesium trisilicate 28-lb. packs 28-lb. lots 1-cwt. lots 5-cwt. lots	4s. 3d. lb. 3s. 10d. " 3s. 7d. "
Bulk rates for larger quantities are from 3s. 1d. lb. in 1-ton lots	
Manganese hypophosphite B.P.C. 7-lb. lots 1-cwt. lots	13s. 11d. lb. 12s. 11d. "
Mercuric chloride B.P. 50-kg. lump	48s. 6d. kg.
Methyl salicylate 1-cwt. lots	3s. 5d. lb.
Morphine Alkaloid, 100 g. Nicotinamide 1 kg.	£138 18s. 4d. kg. £2 10s. 6d. kg.
Nicotinic acid 12½ kg. 1 kg.	32s. 9d. kg. 35s. "
Oleine B.P. extra pale, 3/4 cwt. drums returnable carriage paid G.B.	£160 ton

Phenolphthalein 50 kg.	24s. 3d. kg.
Phosphoric acid B.P. (s.g. 1.750) 10-carboy lots	1s. 4d. lb.
Potassium permanganate B.P. 1-cwt. lots dlvd.	1s. 11½d. lb.
Procaine hydrochloride (foreign) 2 kg.	59s. kg.
Quinine sulphate 100 oz.	2s. 9½d. oz.
Riboflavin 100 g. 10 g.	5½d. g. 7d. "
Saccharin 500 g.	£7 4s. for this quantity
Salicylic acid B.P. 1-cwt. lots dlvd.	3s. 2½d. lb.
Silver nitrate 500 g.	5s. 2d. oz.
Sodium benzoate B.P. 1-cwt. lots 1-ton lots	2s. 9½d. lb. 2s. 7½d. "
Sodium gluconate technical 3-cwt. lots dlvd.	3s. net lb.
Sodium salicylate 50 kg. 12½ kg.	8s. 8d. kg. 9s. "
Sodium thiosulphate Crystals, photographic quality 1-ton lots	49s. cwt.
Stearic acid B.P.C. flake, carriage paid G.B.	£154 ton
Stychnine 25 oz. and under. Alkaloid Hydrochloride Sulphate	11s. 3d. oz. 11s. 3d. " 10s. 3d. "
Sulphaguanidine 12½ kg. 50 kg.	33s. kg. 32s. "
Sulphanilamide 12½ kg. 50 kg.	16s. 6d. kg. 15s. 4d. "
Sulphathiazole 12½ kg.	34s. 6d. "
Tannic acid B.P. Levis 1-cwt. lots	10s. lb.
Tartaric acid B.P. Powder or granulated, in kegs. 1-ton lots	298s. cwt.
Terpineol B.P. 40-gal. drums 1-cwt. lots	2s. 4½d. lb. 2s. 7d. "
Theophylline B.P. 500 g.	27s. 6d. for this quantity
Thiamine hydrochloride 100 g. 1 kg.	3d. g. £9 5s. kg.
Thioglycollate Ammonium Calcium: 7-lb. lots 5-cwt. lots	12s. 4d. to 16s. 4d. lb. 17s. 3d. " 14s. 3d. "
a-Tocopherol 25-g. lots	11½d. g.
Vanillin	23s. 6d. lb.
Zinc oxide B.P. 2-ton lots dlvd.	£107 10s. ton

GENERAL CHEMICALS

Acetic acid 500 gals. bulk dlvd. U.K.	
80% Technical	£81 ton
80% Pure	£87 "
Glacial B.P.	£101 "
98-100% Glacial	£97 "

Acetic anhydride	
1-ton lots dlvd.	£128 ton
Acetone	
5-gal. drums, free, non-returnable	£124 ton
40 to 45-gal. drums, 10-ton lots and over	£80 "
Alum, potassium granular crystals	
50 kg.	1s. 2d. kg.
Aluminium hydroxide B.P.C. 34	
28-lb. lots	2s. 4d. lb.
Aluminium stearate (Standard)	
(Precipitate) 1-ton lots	£233 10s. ton
Ammonia	
Persulphate	£6 13s. 6d. cwt.
Phosphate: Mono-	£106 ton
Di-	£97 10s. "
Amyl acetate	
B.S.S. 10 tons and over	£251 ton
Technical	£249 "
Amyl alcohol	
Technical in 1-ton lots	£256 ton
Arsenic White powdered ex store	£42 ton
n-Butyl acetate	
10-ton lots in drums	£165 ton
n-Butyl alcohol	
10-ton lots in drums	£137 10s. ton
Calcium chloride	
Solid and Flake, dlvd. in 1-ton lots	£16 10s. ton
Calcium oxide (Lime)	
Ex marble 28-lb. lots	3s. 10d. lb.
Caustic soda	
Solid in drums, dlvd.	£37 16s. 6d. ton
Flake in drums, dlvd.	£35 10s. 6d. ton
Chloroform B.P. 1-ton lots	2s. 11½d. lb.
Chromic acid	
Dlvd. U.K. (less 2½%)	2s. 0¼d. to 2s. 0½d. lb.
DDT (Technical)	3s. lb.
2 : 4-Dichlorophenoxyacetic acid	
99% pure, 1-cwt. bags	£320 ton
Dimethyl sulphate	
3-cwt. drums	1s. 11d. lb.
Ether (Diethyl ether)	
Tech. B.S.S. and Solvent B.P.	
1-ton lots in drums	2s. lb.
Ethyl acetate	
10-ton lots in drums	£137 ton
Ethyl alcohol	
95% Gay Lussac 66.0 o.p.	
Synthetic grade, min. 2,500 bulk gal.	3s. proof gal.
Fermentation grade, ditto	3s. 9d. proof gal.
Ferrous sulphate 50 kg.	1s. 4d. kg.
Formaldehyde	
40% by volume dlvd. England	
1-ton lots	£37 5s. ton
Glycerin	
1-2627 s.g. chem. pure, 5 tons and up,	
5-cwt. drums	£241 10s. ton
1-2627 s.g. technical grade, 5 tons and up,	
5-cwt. drums	£236 10s. ton
Hexamine	
1-ton lots	
Technical, bulk	1s. 7d. lb.
B.P.C.	1s. 10d. lb.
Hydrochloric acid	
Commercial	18s. 6d. cwt.
Hydrogen peroxide 1-cwt. lots	
27.5% weight	£115 ton
35% weight	£138 "

Lactic acid (1-ton lots)	
Edible. 50% by weight	1s. 4½d. lb.
Dark tech. 44% by weight	9d. lb.
Magnesium chloride	
Solid (ex wharf): 1-ton lots	£18 10s. ton
Magnesium sulphate	£17 ton
Mercurous chloride (calomel)	
50 kg.	65s. kg.
Mercury sulphide, red	
Ton lots and over	30s. 6d. lb.
Methylated spirits (Industrial)	
Perfumery quality 500 gal. and upwards:	
64 o.p.	6s. 11d.
74 o.p.	7s. 6d.
5 gal.:	
64 o.p.	8s. 7½d.
74 o.p.	9s. 2½d.
Methyl ethyl ketone	
10 tons dlvd. in drums	£134 10s. ton
Methyl isobutyl carbinol	
10 tons and up, in drums, dlvd.	£159 ton
Naphthalene	
Crystal, dlvd., 4-ton lots, spot	£66 ton
Ball and flake (ditto)	£86 15s. "
Nickel sulphate	
dlvd. ton lots	£189 ton
Nitric acid 70% intermediate	£36 ton
Pentachlorophenol	
Flake, technical, in 100 lb. fibre/steel kegs dlvd.	2s. 4d. lb.
Phenol Ice crystals:	
1 ton dlvd.	1s. 5d. lb.
10 tons and over dlvd. in returnable	
45 gal. drums	1s. 3d. lb.
Phthalates	
10-ton lots in drums	
Diethyl (B.S.)	£201 ton
Dimethyl (B.S.)	£194 ton
Potassium bromide	
50 kg.	5s. 6d. kg.
12½ kg.	5s. 8d. "
Potassium carbonate	
Calcined 96 to 98% (1-ton lots ex store) in bags	£75 10s. ton
Hydrated (1-ton lots)	£74 "
Potassium fluoride	
28-lb. lots	5s. 1d. lb.
Potassium sodium tartrate	
5-cwt. lots in kegs	£11 cwt.
Soda ash	
1-ton lots non-returnable 2 cwt. bags.	
from £13 15s. 6d. to £15 16s. 6d. ton	
Sodium hydroxide 28-lb. lots:	
sticks (1-lb. bottles)	4s. 3d. lb.
pellets "	3s. 9d. "
Sodium metal 28-lb. lots	3s. 8d. "
Sodium metasilicate	
Dlvd. U.K. in ton lots	£26 ton
Sodium phosphate	
Dlvd. ton lots: Di-sodium, crystal-line	£40 10s. ton
Anhydrous	£88 "
Tri-sodium, crystalline	£39 "
Anhydrous	£86 "
Sodium silicate according to grade	
dlvd. in drums	£12 10s. to £19 15s. ton

Sodium sulphate Ex-works:	
(Glauber salt)	£13 ton
(Salt cake) unground, full truck loads	£8 16s. 6d. ton
Sodium sulphide	
Broken, returnable drums, dlvd. ton lots	£39 2s. 6d. ton
Flake, ditto	£40 12s. 6d. "
Solid ditto	£38 2s. 6d. "
Sodium sulphite	
Commercial crystals	£27 5s. ton
(Dlvd. London in 2-cwt. single non-returnable bags)	
Sodium tripolyphosphate	
1-ton lots	£95 ton
Stannic chloride 28-lb. lots	8s. 11d. lb.
Stannous chloride 28-lb. lots	9s. 5d. lb.
Strontium carbonate	
96-98% 28-lb. lots	3s. lb.
Sulphuric acid , ex-works, according to quality and quantity	
B.O.V. 78% from 8s. to 10s. cwt.	
C.O.V. 96% from 11s. to 14s. cwt.	
Zinc chloride	
28-lb. lots sticks	6s. 9d. lb.

OILS AND FATS

Palm kernel oil	
Refined, deodorised, 2-ton lots, naked, ex-works	£112 ton
Palm oil	
Refined, deodorised, 2-ton lots, naked, ex-works	£106 ton
Stearine	
dlvd. free bags	
Pristerene 64 flake	£148 ton
Pristerene 62 flake	£133 "
Pristerene 61 flake	£113 "
A premium of £2 ton is charged for powder and £4 for block	

GUMS AND WAXES

Agar Agar No. 1	
Kobe strip	16s. 6d. lb.
Powder	20s. "
Beeswax	
Dar-es-Salaam spot (nominal)	
Sudan spot (duty paid)	£26 10s. cwt.
Bleached white (slab)	£24 "
Refined yellow (slab)	£29 10s. "
Benzoin	
Sumatra spot	£26 10s. cwt.
Siam spot	£2 5s. lb.
Candelilla Spot	£23 15s. cwt.
Carnauba	
Prime, Spot	£38 cwt.
Fatty grey	£28 "
Gum arabic Lump	£9 cwt.
Karaya Powder, Spot	3s. 4d. lb.
Paraffin wax	
1-ton lots, acc. to grade	£105 to £130 ton
Peru balsam	10s. lb.
Shellac	
No. 1 orange	£14 cwt.
No. 2 orange	£12 10s. "
Transparent white	4s. 3d. lb.
Pale dewaxed	6s. "
Tragacanth	
No. 1 spot	£152 10s. cwt.
No. 2 spot	£145 "
Pale leaf	£65 "
Amber	£38 "
Brown to Red	£29 "

NEW TRADE MARKS

APPLICATIONS

Miscellaneous

ANIMERT V 101. — 808,548. *N.I. Philips-Duphar.*
SNO-DENT. — 809,907. *The International Export and Import Corp. Ltd.*
MOUNTAIN MIST. — 810,790. *Petama Polishes Ltd.*
NERVOMAX. — 810,110. *British Chemotherapeutic Products Ltd.*
DURABOND. — 811,668. *Irwin, Neisler and Co.*
IMPERACIN. — 812,112. *Imperial Chemical Industries Ltd.*

Cosmetics and toilet preparations

CELUI. — B790,543. *Les Parfums Jean Dessès.*
ARGENTA. — B798,489. *Washburn Laboratories Inc.*
L'AIGLON. — 804,637. *L'Aiglon Apparel Inc.*
KRISS. — B809,080. *County Laboratories Ltd.*
NUCTA BONNIE. — 807,706. *Stewart, Goodall and Dunlop Ltd.*
MENTAL. — B809,081. *County Laboratories Ltd.*
AMICO. — 810,305. *The International Import and Export Corporation Ltd.*
HAIRDREX. — 810,696. *Phillips, Scott and Turner Ltd.*
MIDSHIP. — 810,784. *Société des Essences Aromatiques et Matières Premières.*
DRUMBEAT. — 813,478. *Cussons, Sons and Co. Ltd.*

Pharmaceuticals

ADEFLO. — 798,065. *Upjohn of England Ltd.*
LAREX. — 804,034. *Ed. Geistlich Sohn A.G.*
BIVAN. — 805,883. *INGOMUN. — 805,886. C. H. Boehringer Sohn.*
GUMOKARE. — B805,910. *Crane-Hall International.*
SANZYME. — 806,169. *Sankyo Kabushiki Kaisha.*
RAUMALGINE. — 806,675. *Organon Laboratories Ltd.*
THIODRIL. — 806,803. *ACDRILE. — 806,806. Société Commercial d'Applications Industrielles.*
LEVOPULSE. — 807,051. *Laboratoires Badrial S.A.*

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Miscellaneous

Iso-benzomorphan derivatives. *Smith Kline and French Laboratories.* 862,249.
Microtomes. *LKB-Produkter Fabriksaktiebolag.* 862,412.
Process for the production of dibenzthiazyl disulphide. *Farbenfabriken Bayer A.G.* 862,519.
Di-isopropylammonium salts of chloroacetic and chloropropionic acids. *Italaseber S.p.A.* 862,248.
2-oxo-benzthiazoline derivatives and herbicidal compositions containing them. *Boots Pure Drug Co. Ltd.* 862,226.
Preparation of polyurethanes. *Farbenfabriken Bayer A.G.* 862,232.
Production of chloroprene. *Distillers Co. Ltd.* 862,500.
Hydrazides, their preparation and compositions containing them. *Shell Research Ltd.* 861,949.
Thioxanthene derivatives and salts thereof and a process for the manufacture of same. *F. Hoffmann-La Roche and Co. A.G.* 862,202.
Thioxanthene derivatives and salts thereof and a process for the manufacture of same. *F. Hoffmann-La Roche and Co. A.G.* 862,203.
Substituted styryl ketones and a process for the preparation thereof. *F. Hoffmann-La Roche and Co. A.G.* 862,053.
Aromatic organic diphosphines. *Imperial Chemical Industries Ltd.* 859,741.
Pyrimidines and their salts and a process for their production. *Cilag-Chemie A.G., formerly Cilag Ltd.* 859,716.
Unsaturated acids and esters thereof and a process for the manufacture and conversion of same. *Roche Products Ltd.* 859,897.
Process for the manufacture of aromatic hydrocarbons. *Farbwerke Hoechst Aktiengesellschaft Vorm. Meister, Lucius and Brünig.* 859,439.
Macrocylic thialactones and process for the preparation thereof. *Chemische Fabrik Naarden N.V.* 859,392.
Process for the production of borohydrides. *Farbenfabriken Bayer A.G.* 859,468.
New patents are from the *Journal of Patents*, and new trade marks are from the *Trade Marks Journal*. In each case permission to publish has been given by the controller of Her Majesty's Stationery Office. Each of the publications mentioned is obtainable from the Patent Office, 26 Southampton Buildings, London, W.C.2.

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C.2.

Prestbury Pharmacy Ltd. 8.2.61. 5 High Street, Prestbury, Cheltenham. £1,000. Dirs.: W. T. and E. M. Rees.

Parfumerie Seger Ltd. 9.2.61. Mnfrs. and dtrs. in unguents, oleaginous and saponaceous substances, toilet requisites, perfumes. £100. Sub.: P. L. Burgin, 3 Grays Inn Place, London, W.C.1.

Roland C. Heath Ltd. 10.2.61. To take over the bus. of mnfrs. of veterinary and agricultural chemicals cd. on by R. C. Heath and J. Sanker as "Helman Chemicals" at 13 Redcliffe Square, London, S.W.10. £100. Dirs.: R. C. Heath and E. H. Caswell.

H. R. Sharp (Chemists) Ltd. 13.2.61. 2 Marlborough Place, Brighton. £1,000. Dirs.: L. K., K. I. and M. J. Sharp.

Pain and Powell Ltd. 13.2.61. 52 High Street, Sevenoaks, Kent. To take over bus. of a chemist and druggist cd. on at Sevenoaks by A. Beveridge (Holdings) Ltd. £4,700. Dirs.: J. O. Macdonald, Phyllis I. Macdonald and A. W. Pain.

CIBA United Kingdom Ltd. 7.3.61. 96 Piccadilly, London, W.1. To acquire not less than 90% of the issued shares in the capital of Ciba Laboratories Ltd., Ciba (A.R.L.) Ltd., and Ciba Clayton Ltd., and the whole or any part of the issued shares in the capital of Clayton Aniline Co. Ltd., and to act as the parent company of such companies. £3,000,000. Dirs.: to be apptd. Subs.: E. Tindell and M. I. Wordley.

Bell Green Pharmacy Ltd. 7.3.61. 21 Queens Road, Coventry. £1,500. Dirs.: Roy O. Chew and John B. Carroll.

Sprince Pharmacies Ltd. 8.3.61. 11 Molyneux Way, Liverpool 10. £1,000. Dirs.: Michael Sprince and Nathan Ratoff.

C. Swift (Chemist) Ltd. 9.3.61. 256 Lee High Road, London, S.E.13. £1,000. Dirs.: Claude and Gladys Swift.

Chalfont Laboratories Ltd. 10.3.61. Ragstones, Cheries Avenue, Little Chalfont. Suppliers, exporters, importers and distributors of and dtrs. in liquid dispensers for hospital use and other hospital and medical equipment. £100. Dirs.: to be apptd. Subs.: R. P. Rodgers and N. A. Weekes.

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From MANUFACTURING CHEMIST

May 1896

Tariff decisions in France

Thorium salts, especially nitrate of azotate, solutions of which are used in the preparation of incandescent gas burners, belong to the class "chemical products not denominated, other than of an alcoholic basis," and pay a duty of 5% *ad valorem*. The estimation of the value of these products having given rise to many disputes, the departments of trade and finance have decided to convert the duty of 5% into an equivalent specific rate, and considering that the value of thorium salts, once £36 5s. 6d. lb., is now only about £7 5s. 1½d. lb. on account of recent discoveries of thorium ore, it has been decided to substitute for the duty a specific rate of 7s. 3d. lb.



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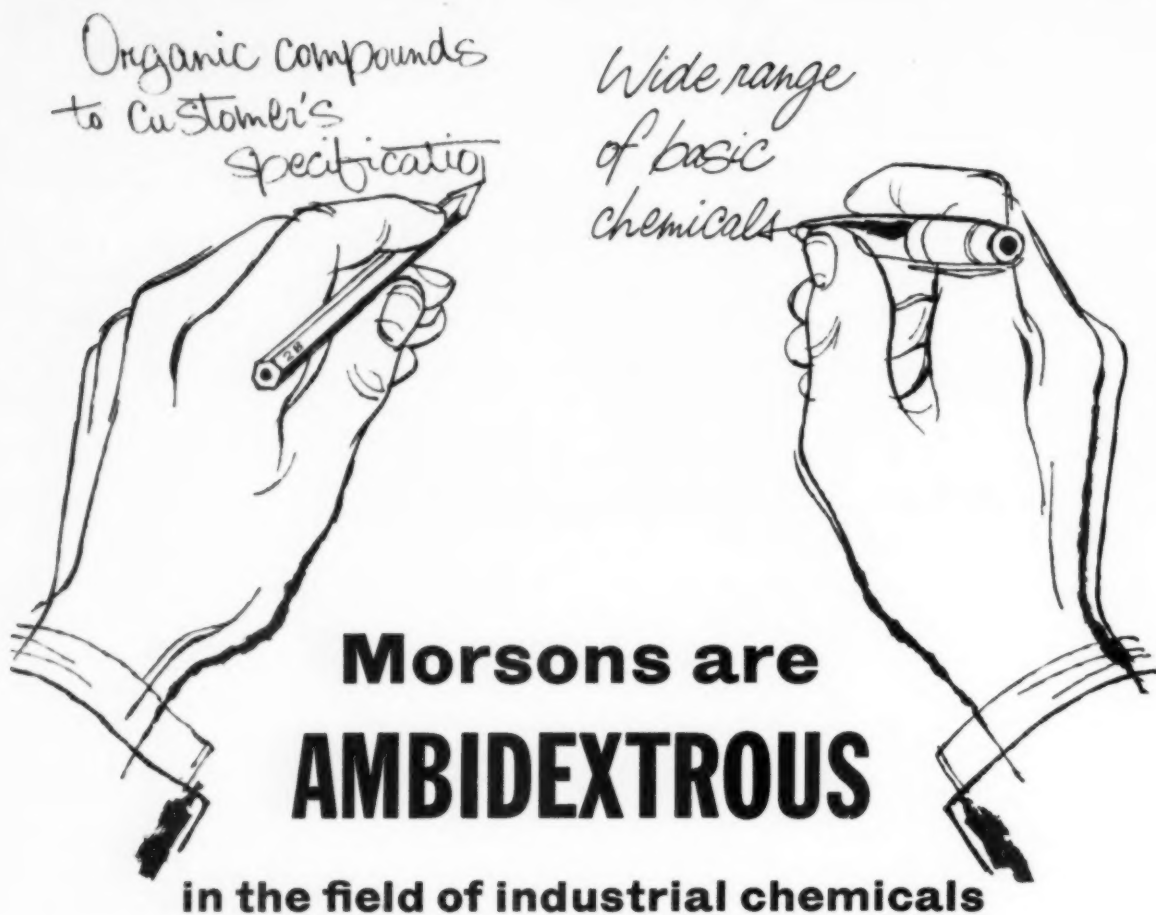


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Manufacturing Chemist—May, 1961

M 83

A69



On the one hand, Morsons are well-equipped with the right plant and technical "know-how" to manufacture organic compounds to customers' own specifications (after all, they have been doing just this for over one hundred years).

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BISMUTH OXIDE B.P.C. 1934
BISMUTH SALICYLATE B.P.C. 1954
BISMUTH SUBGALLATE B.P.C.
BISMUTH SUBNITRATE B.P.C.

BROMOFORM B.P.C. and s.g. 2.9

CADMIUM ACETATE
CADMIUM CHLORIDE
CADMIUM IODIDE

FERRIC AMMONIUM CITRATE B.P.
POTASSIUM CITRATE B.P.
SODIUM CITRATE B.P.

GLYCEROPHOSPHORIC ACID 20% B.P.C. and 35%
CALCIUM GLYCEROPHOSPHATE B.P.C.
MAGNESIUM GLYCEROPHOSPHATE B.P.C.
MANGANESE GLYCEROPHOSPHATE N.F.
POTASSIUM GLYCEROPHOSPHATE 50% B.P.C.

SODIUM GLYCEROPHOSPHATE 50% B.P.C.
and 75%
75% and B.P.C. 1949
HYDROCYANIC ACID 2% B.P.C. 1954 and
4% B.P.C. 1934

AMMONIUM IODIDE B.P.C. 1934
IODINE B.P.
IODOFORM B.P.C. 1954
POTASSIUM IODATE
POTASSIUM IODIDE B.P.
POTASSIUM IODIDE/CALCIUM STEARATE
SODIUM IODIDE B.P.

OXALIC ACID RECRYST
AMMONIUM OXALATE
FERRIC AMMONIUM OXALATE
POTASSIUM OXALATE

PHENOLPHTHALEIN, AMORPHOUS

SODIUM PHENOLSULPHONATE B.P.C. 1949
ZINC PHENOLSULPHONATE B.P.C. 1949

POTASSIUM DIHYDROGEN
PHOSPHATE B.P.C. 1949
POTASSIUM PHOSPHATE B.P.C. 1949
SODIUM DIHYDROGEN PHOSPHATE B.P.

SODIUM NITRITE B.P.C.

ZINC SULPHATE B.P.

Yes! Morsons are ambidextrous

Thomas Morson & Son Ltd., Summerfield Chemical Works, Enfield, Middlesex

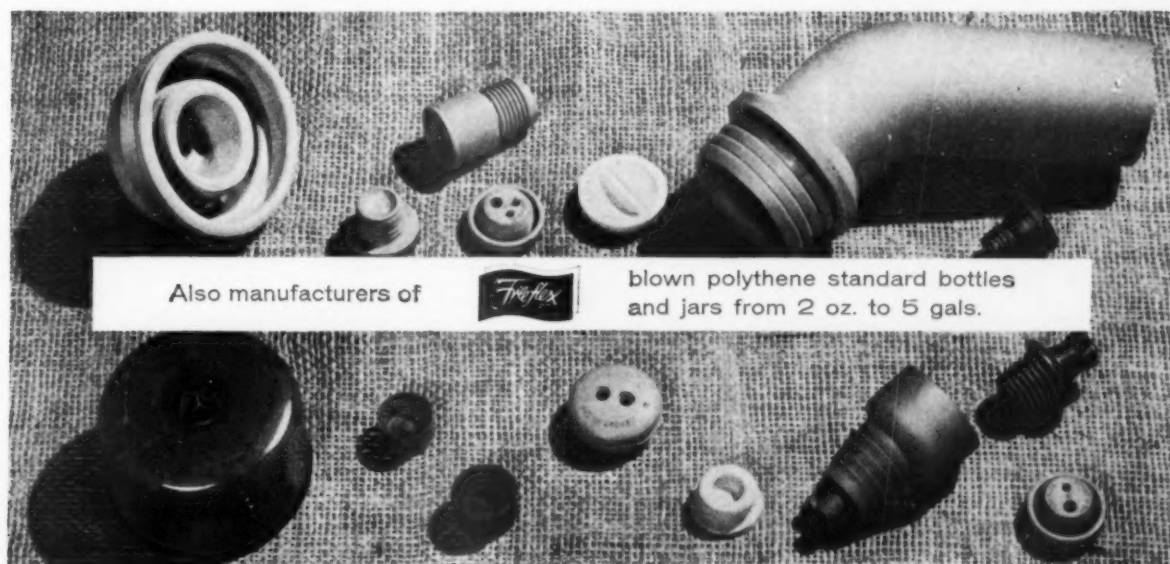


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Manufacturing Chemist—May, 1961

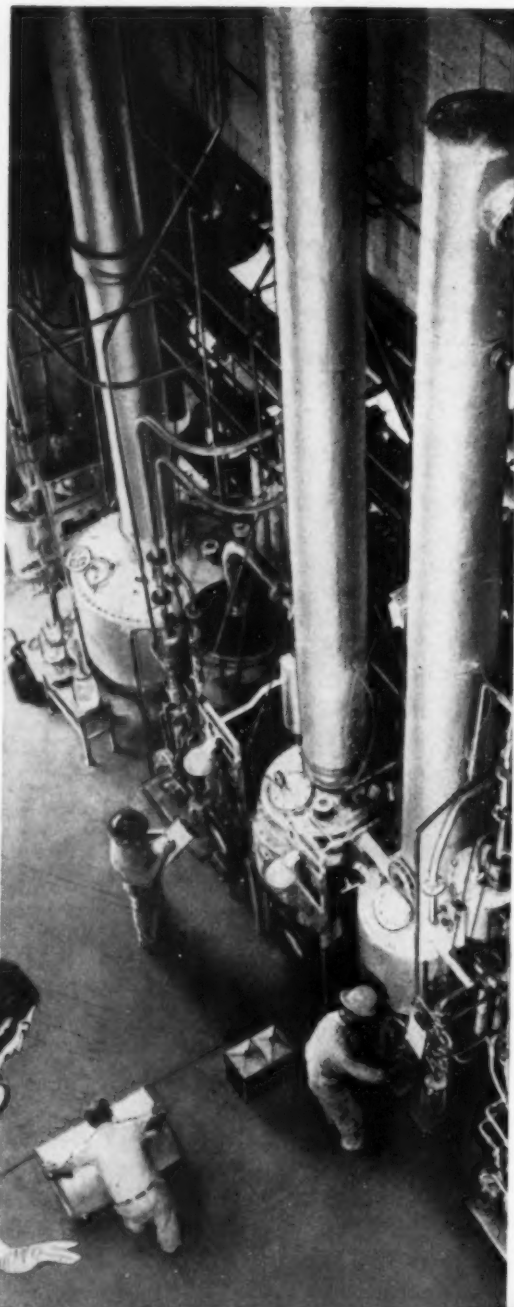
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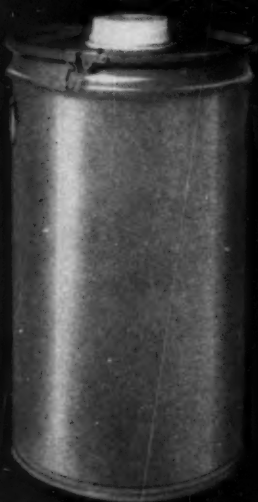
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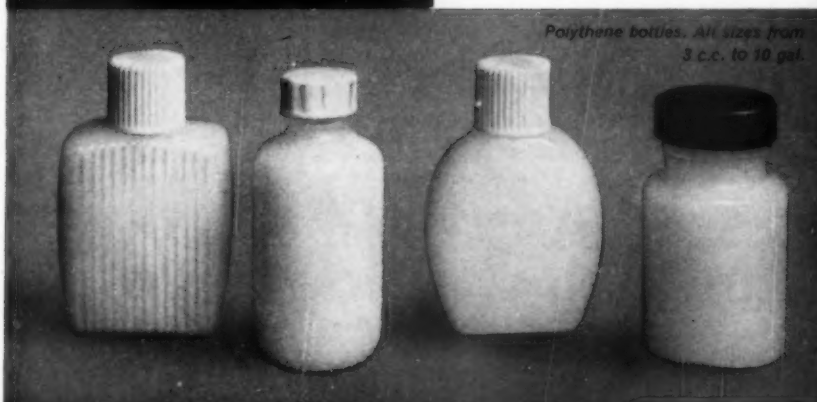


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BAGS
ARMOURED BOTTLES

UNBREAKABLE Cascelloid CONTAINERS



Cascelloid ranges of polythene tubes, bottles, packs and other specialised containers may well provide the perfect solution to your packaging problems. Wealth of experience and scale of production enable Cascelloid containers—lightweight and virtually indestructible—to be offered in great variety at realistic prices. They are suitable for almost any type of contents.



Polythene bottles. All sizes from 3 c.c. to 10 gal.



Lightweight containers 1 pint to 1 gallon.



Polythene film bags—translucent and tough.

Samples, suitability checks, prices, advice from:



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STABLE EMULSIONS

The makers of the well-known anionic emulsifier

"LANETTE" WAX SX
(Regd. Trade Mark)

now recommend with confidence their non-ionic self-emulsifying wax

"LANBRITOL" WAX N2I
(Regd. Trade Mark)

Introduced just four years ago, it is now in regular bulk use by a large number of cosmetic and pharmaceutical manufacturers, who report it to be unequalled for the following purposes:

SPECIFIC USES. For o/w emulsions of all consistencies where anionics are contra-indicated, viz.:

- (1) Where the cosmetic, antiseptic, therapeutic or antibiotic ingredient is **cationic** in structure.
- (2) With salts of **polyvalent** metals such as aluminium, zinc, strontium and lead, e.g. deodorant creams.

GENERAL USES. For all thin emulsions, e.g. from milks to pourable creams, irrespective of the ionic nature of the components
Such thin emulsions are normally difficult to make in stable form; but with "Lanbritol" Wax N2I processing is simple and the stability achieved is quite remarkable.

Write for booklet giving full details and tested illustrative formulae to the sole manufacturers:

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Telephone: SLOane 7600 Telegrams: Gardinol Sowest London





*Have you a
sealing problem?*

If so, have you considered how the use of Alu-Pharm adhesive aluminium bottle capsules could be the immediate answer to your problem? The adhesive coating ensures a perfect seal, making your product tamper-proof.

The Alu-Pharm capsules are available in a large range of colours and sizes suitable for sealing bottles whichever closure is used.

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OFFER



WARD, BLENKINSOP & CO LTD
FULTON HOUSE, EMPIRE WAY,
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Substituted Benzophenones with a high absorption in the ultra-violet. Designed for the protection of plastics and other materials sensitive to UV light.

Gallates:

Gallic acid esters of dodecyl, octyl and propyl alcohol for the stabilization and prevention of rancidity in edible oils, fats and perfumes.

Lawsone:

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The pure dye present in natural henna. Preferable to the natural compound in the formulation of hair tinting preparations because of its stability and standard tinting power.

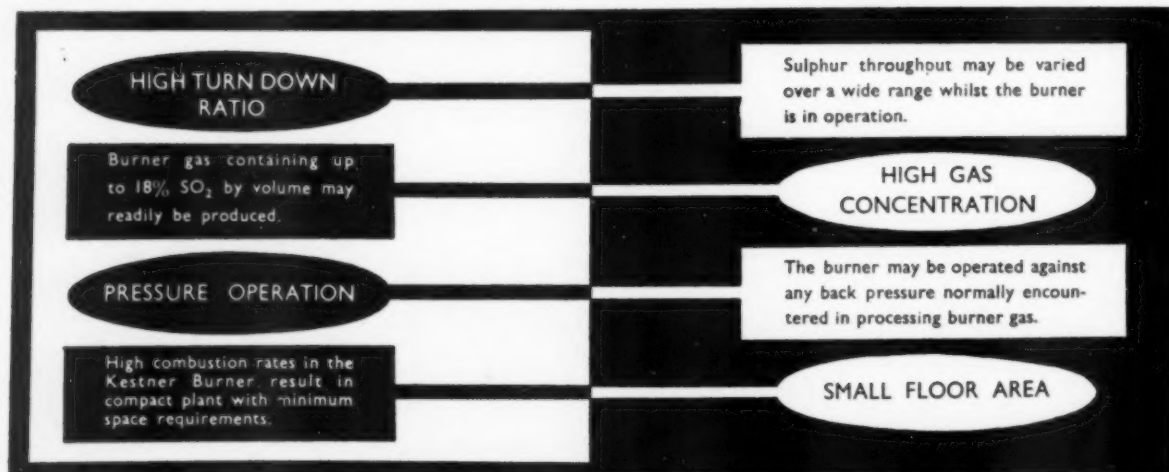
KESTNER PATENT SPRAY TYPE SULPHUR BURNER

A completely new system of burning sulphur developed by Kestners consists essentially of a specially designed atomiser and combustion chamber. Molten sulphur is sprayed into the chamber by means of heated primary air, while secondary or combustion air is introduced at high velocity through a series of nozzles situated around the periphery of the chamber. The highly turbulent conditions produced, coupled with fine sub-division of the sulphur, result in exceptionally high combustion rates and SO_2 concentration.

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Size 1—1 cwt. hour Sulphur	Size 5—12 cwt. hour Sulphur
Size 2—2 cwt. hour Sulphur	Size 6—16 cwt. hour Sulphur
Size 3—4 cwt. hour Sulphur	Size 7—1 ton hour Sulphur
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KESTNER EVAPORATOR & ENGINEERING CO., LTD., 5 GROSVENOR GARDENS, S.W.1



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Here's your first 'purpose-built' container design

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Here's the first—a four-in-one segment stacking jar that could contain four different varieties of your product, or four entirely different products. The segments are separate, each with a snap-on cover and plenty of label room.

This is the kind of container the housewife will be able to use again and again. She'll look out for them in the shops; when she buys the products these jars contain, make sure the labels they are carrying are *yours*.

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Jackson

Packaging Advisory Service

A comprehensive service embracing design and advice on glass containers, closures, labelling, display boxes and outers. This service also offers to manufacturers, packing in containers other than glass, free market research facilities on 'design preference testing', 'container-in-use testing', and 'shelf testing', as well as an area test marketing service at a nominal charge.

Jackson Research Unit

A team of experts, perfecting new types of glass packs and closures. If you have a new product or want to give a new look to an existing one, we may already have the answer for you.



FLASHBACK

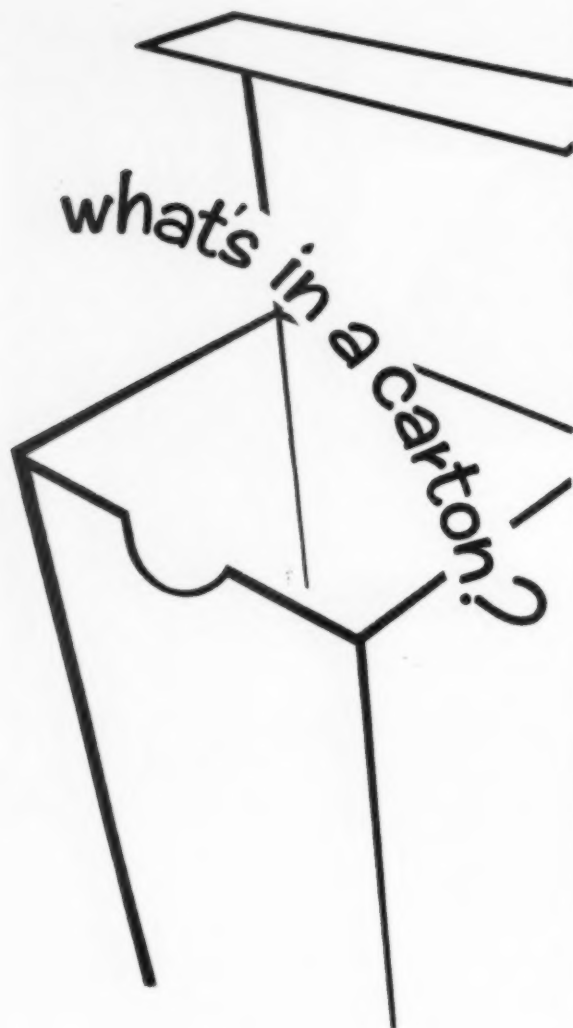
The heads of the Jackson Packaging Advisory service meet John and Sylvia Reid, world-famous industrial designers, to plan your 'purpose-built' containers. These meetings consider every possible aspect of packaging; they produce containers which present your products at their very best; containers that SELL.

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for
a
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Emulsor

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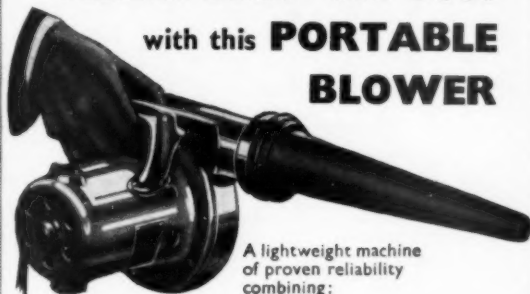
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- A Compelling Suction for industrial cleaning, enabling better maintenance . . . reducing breakdowns and minimising wear.

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High thermal response. Wide range of temperatures.
Standard output air pressure, 3-15 p.s.i. Small and compact.

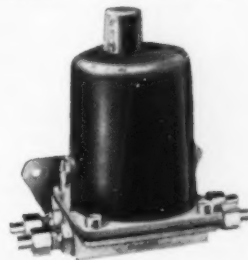
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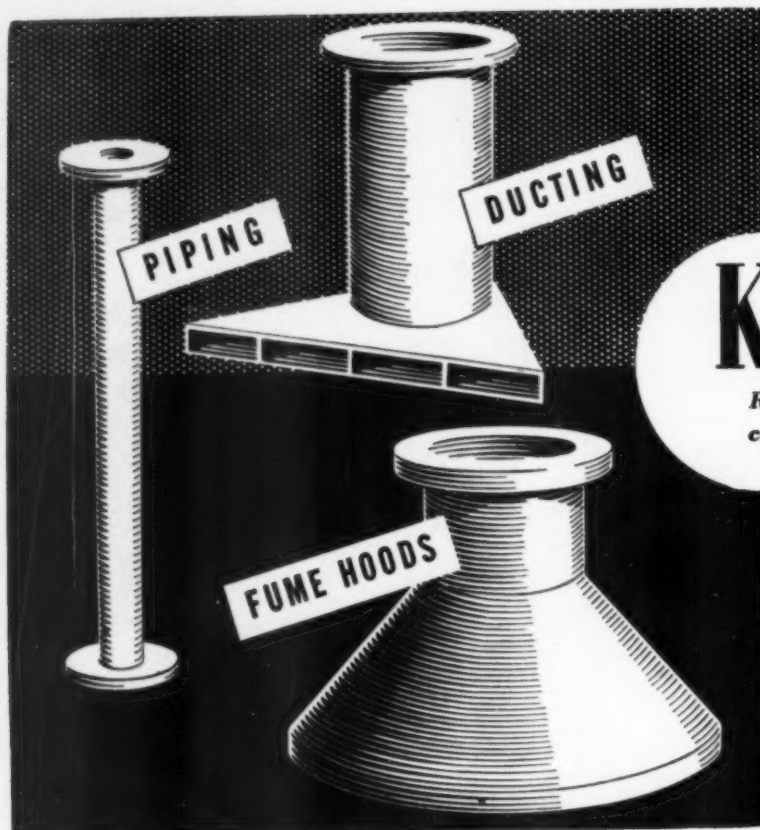
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Dazzle them with figures! Be The Man Who Suggested Solvent Recovery By Sutcliffe Speakman! Face, did we say? My dear Sir! We are offering you Reputation—nay—Prestige!

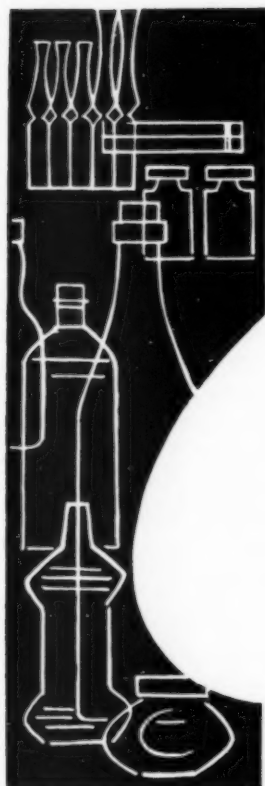
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A82



May, 1961—Manufacturing Chemist



Strunck Machines at Achema 1961

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in the field of the handling of
AMPOULES as well as BOTTLES and CONTAINERS
of glass and synthetic material will
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NEW MONOBLOCK PLANTS for complete
packaging of containers of all kinds.



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Every Gardner machine is designed and made for the job it has been specially designed for a particular purpose. If you are interested in the mixing, sifting, grinding, feeding or drying of powders, solids, pastes, granules or liquids, Gardners can help you.

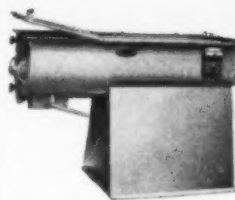
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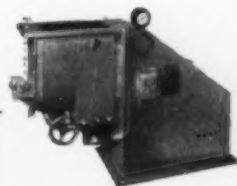
HORIZONTAL MIXER



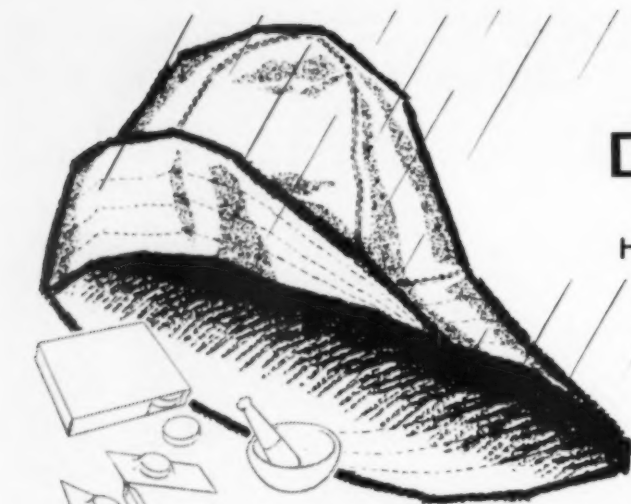
Universally used for mixing all types of dry materials. All metal construction with built-in motor. Self discharge of finished mix. The agitator is easily removed for thorough cleaning on sizes up to 300 lbs capacity. In sizes from 15 lbs to 3 tons.

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Takes the place of drying rooms and stoves. Designed for materials of high moisture content requiring comparatively low temperatures. Used for a wide range of products requiring special handling. Heating medium can be Steam, Gas or Electricity.



Send for illustrated folder of the Gardner range of machines.



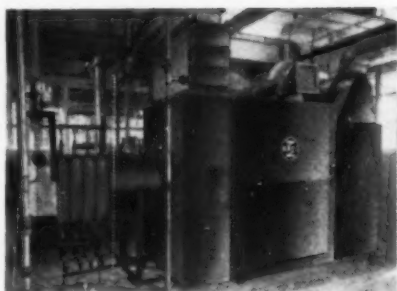
DRY

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Many chemicals and pharmaceutical products are harmed by atmospheric moisture. Damp weather may spoil both the product and the smooth flow of the production processes if atmospheric humidity throughout the plant is not controlled. Birlec Direct Dehumidifiers offer a simple and highly efficient means of holding the relative humidity of a process room or storage enclosure at a safe low level.



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With the Manesty all purpose comminuting machine many processes not previously attempted are brought to a successful conclusion. Due to the unique design of the Fitzmill feed throat, the material is presented to the stainless steel blades, at the correct angle,* in such a manner that most of the work is carried out 'impact in air.' It is for this reason that screens with large holes can be used and the throughput is correspondingly increased. For instance, screens with holes in the region of one inch can be used for wet granulation. An important feature of the Fitzmill is that there is no metal to metal contact in the comminuting chamber and, therefore, no danger of metal contamination in the granulation.

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* Due to the unique reversible, stainless steel comminuting chamber.

SIZE WISE



Illustrated literature on request.

MANESTY FITZMILL

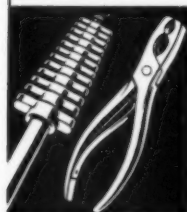
MANESTY MACHINES LIMITED · SPEKE · LIVERPOOL 24

Telephone: Hunts Cross 1972 · Telegrams: Manesty, Liverpool 24

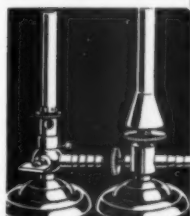


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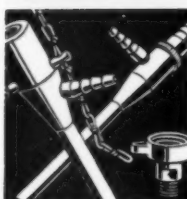
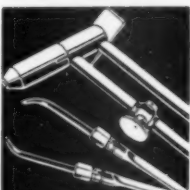
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all current types
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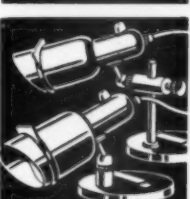
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Including the folks who destroy him with insecticides, those who make the insecticides and those who make the machines that make the insecticides. We are in the third category.

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DE 77/60



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Operated by unskilled labour, this machine can fill bottles, tins, cartons or drums of up to 1½ lb. capacity at speeds of up to 3,600 per hour, depending on the size of container.

The exclusive vacuum operation ensures completely dustless filling—is so efficient that specially reduced insurance rates are obtainable when powders of a deleterious or abrasive nature are filled.

Other models are available with outputs of up to 7,200 containers per hour.

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 $\frac{3}{8}$ " WIDTH — 430 lb. BREAKING STRAIN
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A87

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Sometimes leak...**



**...and People
Sometimes spill...**



**...THERE'S A VERY STRONG ARGUMENT
FOR HAWORTH ACID-RESISTING FLOORS**

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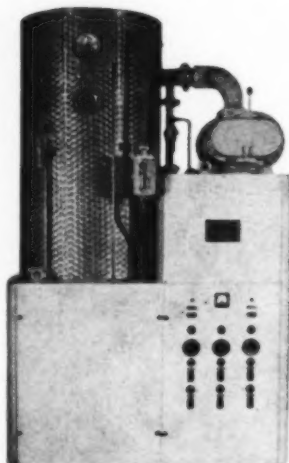
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Models available:
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Heads up to 160 FT.



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TO ANY CONTAINER



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Prints TINS,
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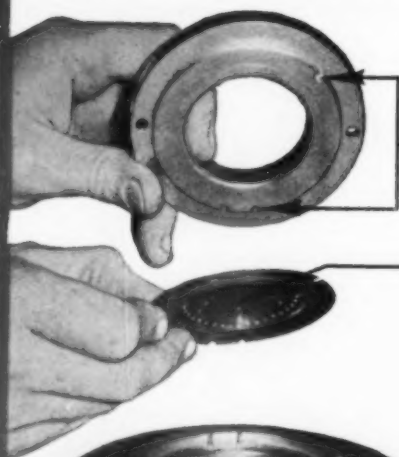


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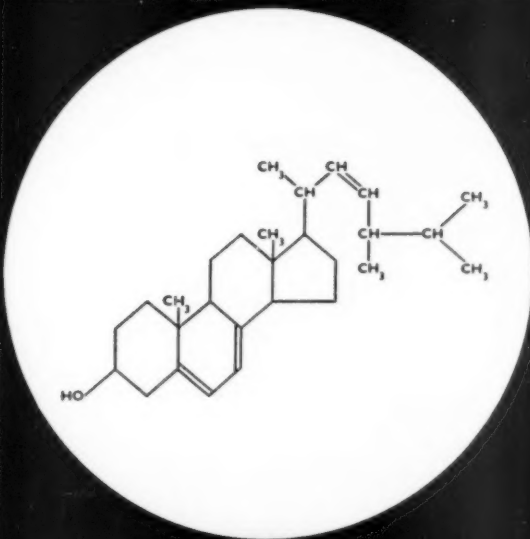


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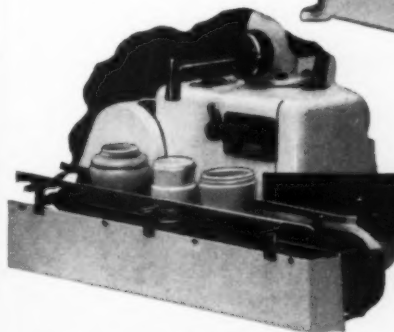
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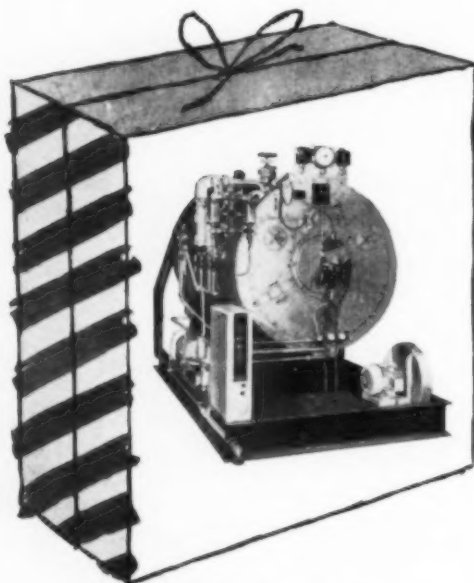
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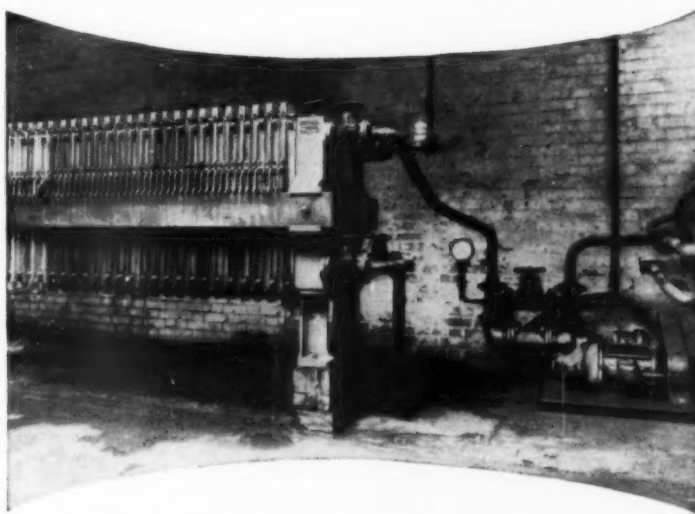
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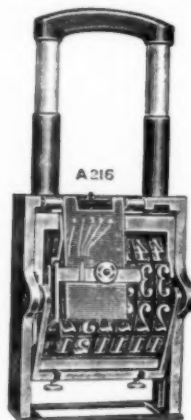
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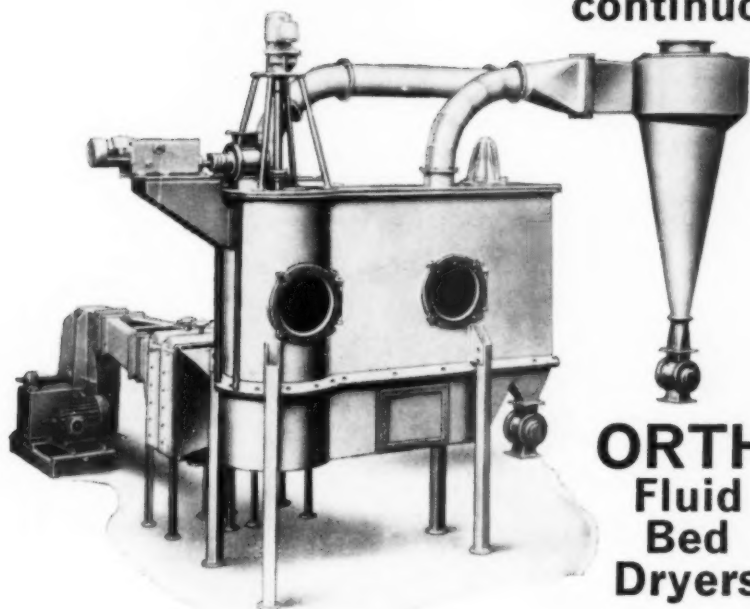
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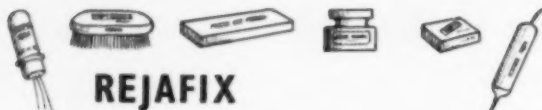
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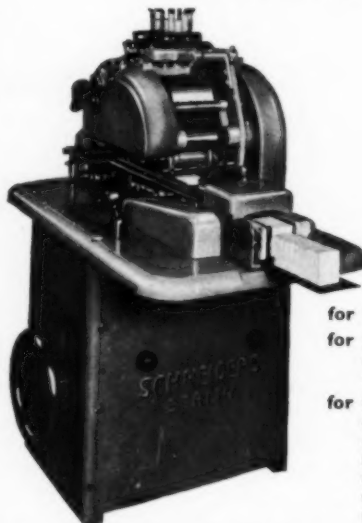
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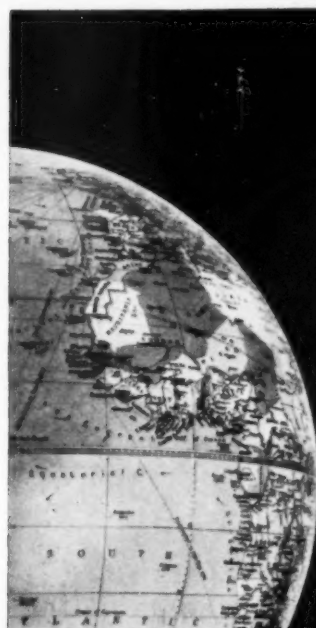
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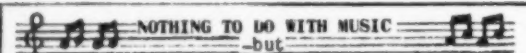
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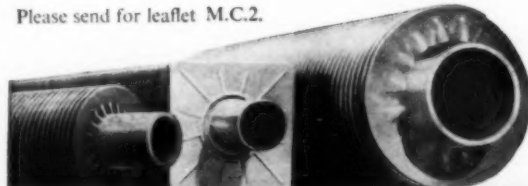
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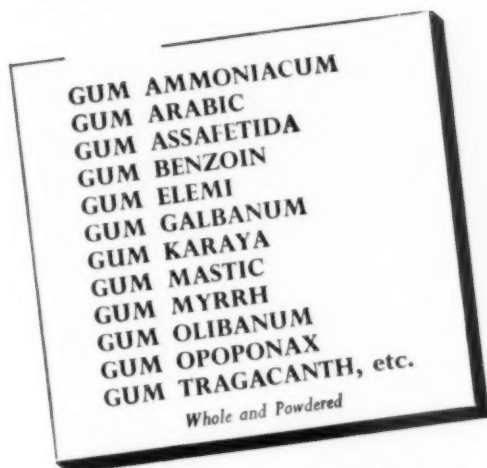
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Ref. B.186. British. Female. Single. Age 22. G.C.E. "A" level Chem., Physics & Maths. R.I.C.-H.N. Certificate. 8 mnths. Analytical & Works Technician, glass bottle mnfr. 2 yrs. Asst. Analytical Chemist, Cosmetics, perfume & fine soap mnfr. Seeks post as **CHEMIST**—pref. in organic field connected with plastics, synthetic resins & polymers. London area—within 30-mile radius. £750 p.a.

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(continued overleaf)

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Ref. B.211. British. Male. Married. Age 40. O.N.C. & H.N.C., A.M.I.Mech.E., A.M.I.Prod.E. 5 yrs. Apprentice, & 2 yrs. Junr. D/man, telephone equip. 1 yr. Senr. D/man, filtration equip. mnfr. 3 yrs. Designer D/man, dental equip. mnfrs. 4 yrs. Design/Devpt. Engr., mech. & elec. engs. At present engaged in Design, Devpt. & mnfr. of prototype scientific equip. & apparatus with medical research concern. Seeks post as SENR. DESIGN/DEVPT. ENGR. OR SIMILAR. Up to 50 miles N. of London or S. coast of England, but not Central or S. London. £1,600 p.a. min.

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Ref. B.213. British. Male. Married. Age 41. C. & G. Mag. & Elect. C. & G. Telephony & Radio Communication Grade I. 7 yrs. Technician, telephone service. 6 yrs. Instrument Mech., army. 6 yrs. Asst. Material Controller, automatic m/c tool mnfrs. At present Buyer, aircraft & electronic instrument mnfrs. Seeks post as BUYER OR ANY SIMILAR POST WHERE EXTENSIVE ELECTRONIC & ENGG. EXPER. OF USE. London, Surrey, Kent or Sussex. £1,000 p.a. min.

Ref. B.214. British. Male. Married. Age 31. H.N.C. Mech. 3 yrs. Apprentice, transformer mnfrs. 6 yrs. Elect. Mech., R.N. 1 yr. Precision Fitter, elec. engs. 4 yrs. Senr. Design D/man, mech. design engs. At present Project Engr. i/c Projects Dept. of mech. handling engs. Wide exper. precision mech. design & design of elec. & hydraulic control circuits, & specialised mech. handling projects (not bulk handling). Seeks post as DESIGN OR PROJECT ENGR. (MECH. OR ELECTRO/MECH.). London or N. London—Dunstable or Luton pref. £1,400/£1,500 p.a.

Ref. B.215. British. Male. Single. Age 32. H.N.C. (Mech.), Grad.I. Mech.E., Inter.B.Sc., Stud.I.Chem.E. 2 yrs. Tech. Sales Asst., chem. mnfrs. 1½ yrs. Machinist, genl. engs. 1 yr. Fitter, aluminium foundries. 3 yrs. D/man, power station pipework & steelwork. 2½ yrs. D/man, chemical plant. 3 yrs. Director, mnfrs. agents. Seeks TESTING OR MAINTENANCE OF CHEM. PLANT POST. Greater London pref. £1,000 p.a.

Ref. B.216. Greek. Male. Married. RESIDENT U.K. B.Sc. (Pt. II) standard in Mech. Engg. Now taking H.N.C. Elect. U.K. exper. includes 1½ yrs. Design D/man, earth moving equip. 1½ yrs. Senr. D/man, consultant contractors. 1 yr. D/man, furnace mnfr. At present Project Design D/man, electrical terminations. Seeks post as PROJECT DESIGN D/MAN. London, Richmond or West Middlesex. £980 p.a. min.

Ref. B.217. British. Male. Married. Age 47. A.M.Inst.W. 2 yrs. Apprentice, instrument makers. 4 yrs. Foreman, genl. engg. 21 yrs. Senr. Representative, technical liaison & sales on use of gases. 1 yr. Representative, high pressure controls. Seeks TECHNICAL LIAISON OR SIMILAR POST. London. £1,200 p.a. approx.

Ref. B.218. British. Male. Married. Age 53. A.C.G.I., A.M.I.Mech.E., A.M.I.E.E., M.I.Mar.E. Exper. includes 29 yrs. Senr. Executive Appointments, govt. depts. abroad, & as agent, representative, contract & inspecting eng. Exper. pressure vessels, boilers, power plants. Seeks post as ELECTRICAL/MECH. ENGR. Pref. abroad but U.K. considered. U.K. salary £1,500 p.a. min.

Ref. B.220. Polish. Male. Married. Age 30. RESIDENT U.K. H.N.D. Mech. Eng. 2 yrs. Graduate Apprentice & 2 yrs. Airflow Laboratory Asst. Engr., steam turbine engg. At present Devpt. & Test Engr., heating, ventilation & air conditioning. Consid. Design exper. on air ducts/piping/exhaust chambers. Seeks post as DEVPT. & TEST ENGR. OR DESIGN ENGR. London. £1,100 p.a.

Ref. B.221. British. Male. Married. Age 41. O.N.C. (Elec.). 1 yr. Resident Engr., city council abroad. 2 yrs. Site (Construction) Electrical Engr. 6 yrs. Senr. D/man, electricity. 1 yr. Tech. Asst.,

county council. At present Contract Manager, mnfr. of control panels & electrical contractors. Seeks post with STABILITY & "JOB SATISFACTION" AS CHIEF D/MAN/CONTRACTS ENGINEER/WORKS MANAGER. E. or S. England, pref. with house.

Ref. B.222. British. Male. Single. Age 23. G.C.E. "A" Level Botany, Zoology & Chemistry Ph.C. 2 yrs. Apprentice & 1½ yrs. Relief Pharmacist, retail chemist. At present Relief Pharmacist, retail chemist. Seeks TECHNICAL TECHNICAL WRITING/EDITORIAL OR PERSONNEL POST, anything considered except retail or hospital work. £800/£850 p.a. approx.

Ref. B.223. British. Male. Single. Age 23. C. & G. Full Tech. Cert. 5 yrs. Apprentice, mech. engg., compressed air engs. 1 yr. Project Mechanic, dust extraction. At present engaged in practical aspect of research & devpt. in dust extraction. Seeks TECHNICAL ADVISORY/SUPERVISORY/DEVPT. POST. Outer London. £13 per week.

Ref. B.224. British. Male. Married. Age 30. 4 yrs. Apprentice, genl. engg. 7 yrs. Engr., Fleet Air Arm. 4 yrs. Tech. Representative, aero engine mnfrs. At present Senr. Sales Engr., hydraulic/pneumatic engs. Good exper. sales office admin. & procedures. Seeks ENGINEERING SALES OR MANAGEMENT POST. U.K.—S. England pref., or Canada or Australasia. £1,100/£1,250.

Ref. B.225. British. Male. Married. Age 26. S.2.S.I. & Maths. Engg. Drawing for M.O.T. 2nd Class Cert. 5 yrs. Apprentice Engr., genl. engs. At present Marine Engr. Officer, shipping company. Seeks post as D/MAN, anywhere considered. £850 p.a.

Ref. B.226. British. Male. Single. Age 29. B.Sc. (Eng.). S.I.Mech.E. 4½ yrs. Systems Engr., aircraft & gunnery. At present Stability & Control Aero Engr., aircraft design & research. 1½ yrs. research of "operational" nature & 6 mths. course in O.R. Seeks post as OPERATIONAL RESEARCH ENGR. U.K. or abroad. £1,450 p.a.

Ref. B.229. British. Male. Married. Age 43. A.M.Inst.Eng. Inspection. 6 yrs. Examiner i/c, eng. tech. grade, govt. dept. 6 yrs. Inspector, m/c tool mnfr. 3 yrs. Inspector, electrical mnfrs. 3 yrs. Apprentice, airline company. At present Technical Assistant, oil company. Seeks OFFSHORE INSPECTION OR EXPEDITOR POST. Pref. London, but would travel in Provinces. £1,000 p.a. min.

Ref. B.230. British. Male. Married. Age 28. O.N.C. & H.N.C. Chem. Pt. I of Grad. R.I.C. 3 yrs. Lab. Assist., pharmaceuticals. 4 yrs. Analyst & 3 yrs. Asst. Head of Productivity, heavy inorganic chemicals. At present Prod. & Packaging Manager, ethical pharmaceuticals. Has had training in Work Study & exper. management & operator training. Seeks post as PRODUCTION EXECUTIVE. U.K.—pref. Manchester area. £1,250 p.a.

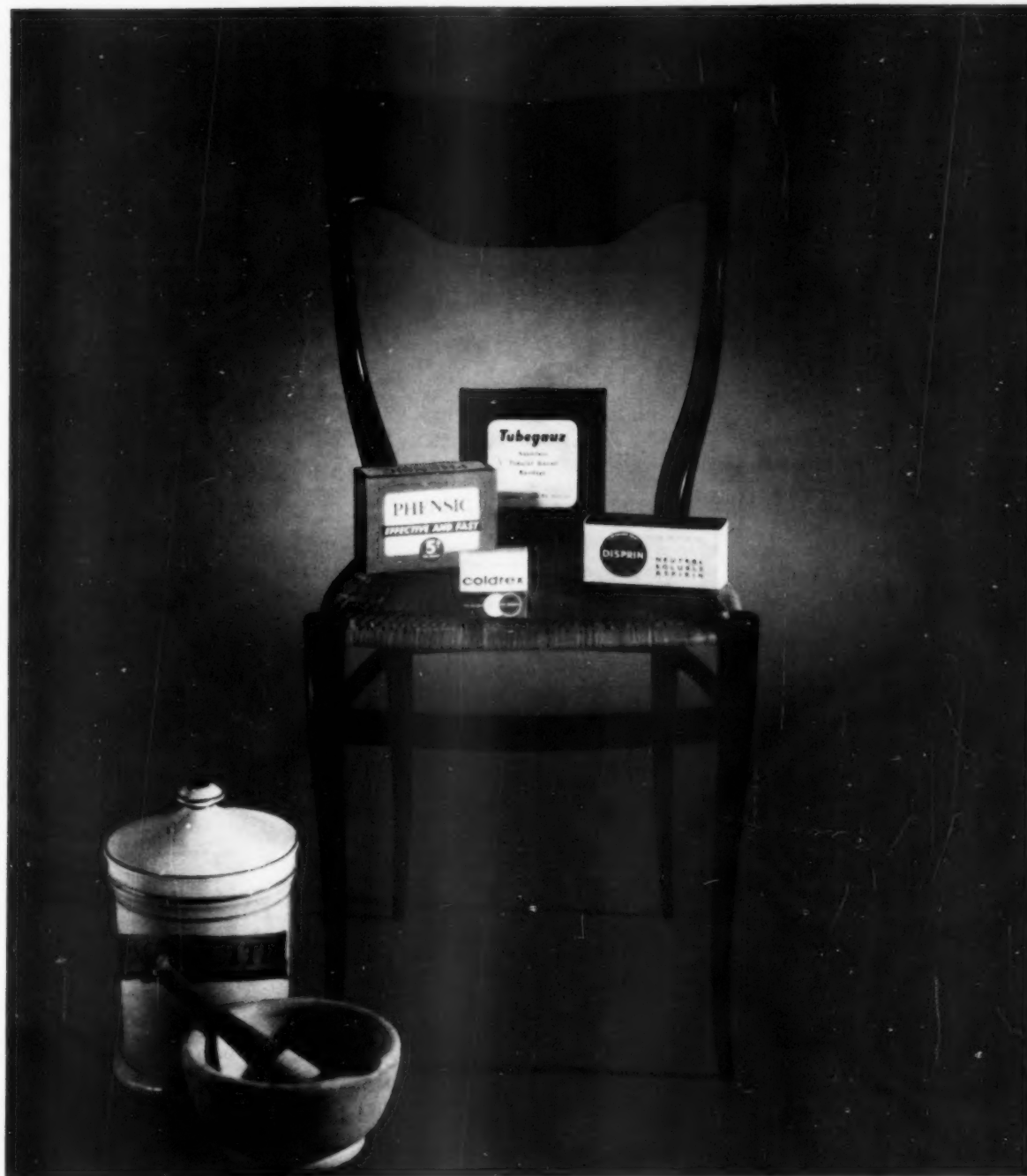
Ref. B.231. British. Male. Married. Age 55. M.I.Prod.E., M.Inst. Work Study. 5 yrs. Jig & Tool D/man, telephones. 1 yr. Tool Designer, radio. 12 yrs. Chief Tool D/man, cameras. 2½ yrs. Chief Engr. & 1½ yrs. Chief Prod. Engr., loudspeakers. 4 yrs. Works Manager, aircraft fuelling. At present Chief Planning Engr., automobile suspensions. Specialist on press work & single spindle autos. Seeks post as PROD. ENGR. U.K.—S. of the Wash. £1,750 p.a.

Ref. B.233. British. Male. Married. Age 41. A.M.Inst.E. A.M.I. Plant E. 8 yrs. Apprentice Foreman, boiler setters, chimney bldg., refractory specialists. 1 yr. Toolroom Training, dynamo mnfr. 7 yrs. Furnace bldg. & designing, research & devpt. 10 yrs. From Research Asst. to Research Officer, & Asst. Plant Engr., research & devpt. At present Research Officer & Asst. Plant Engr., devpt. work in Boiler Dept., fuel utilisation research. Exper. pneumatic handling of small fuel. Seeks post as TECHNICAL REPRESENTATIVE OR SIMILAR U.K. or Australia. £1,000 p.a. min.

Ref. B.234. British. Male. Married. Age 37. B.Sc. (Hons) (Mining Eng.). A.M.I.Min.E., Colliery Managers Cert. 9 yrs. Junr. Tech. positions, coal. 3½ yrs. Mine Manager, colliery proprietors abroad. At present Mining Engr./Tech. Sales Rep., mining m/cy mnfrs. Exper. control of team of service engs., sales office procedure, devpt. projects for stratified & nonstratified deposits—both open cut & deepmined methods. Seeks post as SALES MANAGER MINING ENGR. Anywhere U.K. Salary £2,000 p.a.

Ref. B.236. British. Male. Married. Age 35. O.N.C. & H.N.C. Elec. & Mech. A.M.I.E.E. 3 yrs. Apprentice Engr., bldg. dept. of property owners. 7 yrs. Engr./Surveyor, engg. insurance company. At present Inspector of Factories (Engg.), overseas civil service. Consid. exper. as Local Govt. Lecturer. Seeks post as SAFETY ENGR. OR INSPECTOR OF PLANT, OR SIMILAR. Anywhere considered. £1,500 p.a. min.

Ref. B.237. British. Male. Married. Age 29. O.N.C. Mech. & now studying for H.N.C. M.Soc. Instrument Technology. 5 yrs. Instrument Maker/Improver, clocks & fine mechanisms. 3 yrs. D/man, printing & packaging m/cy. 4 yrs. Designer D/man, fine electro-mech. devices. 1½ yrs. Devpt. Engr., indust. instruments. At present Devpt. Engr., indust. instruments. Seeks post as DEVPT. ENGR. OR SENR. POST. IN DEVPT. D.O. London area. £1,000 p.a. approx.



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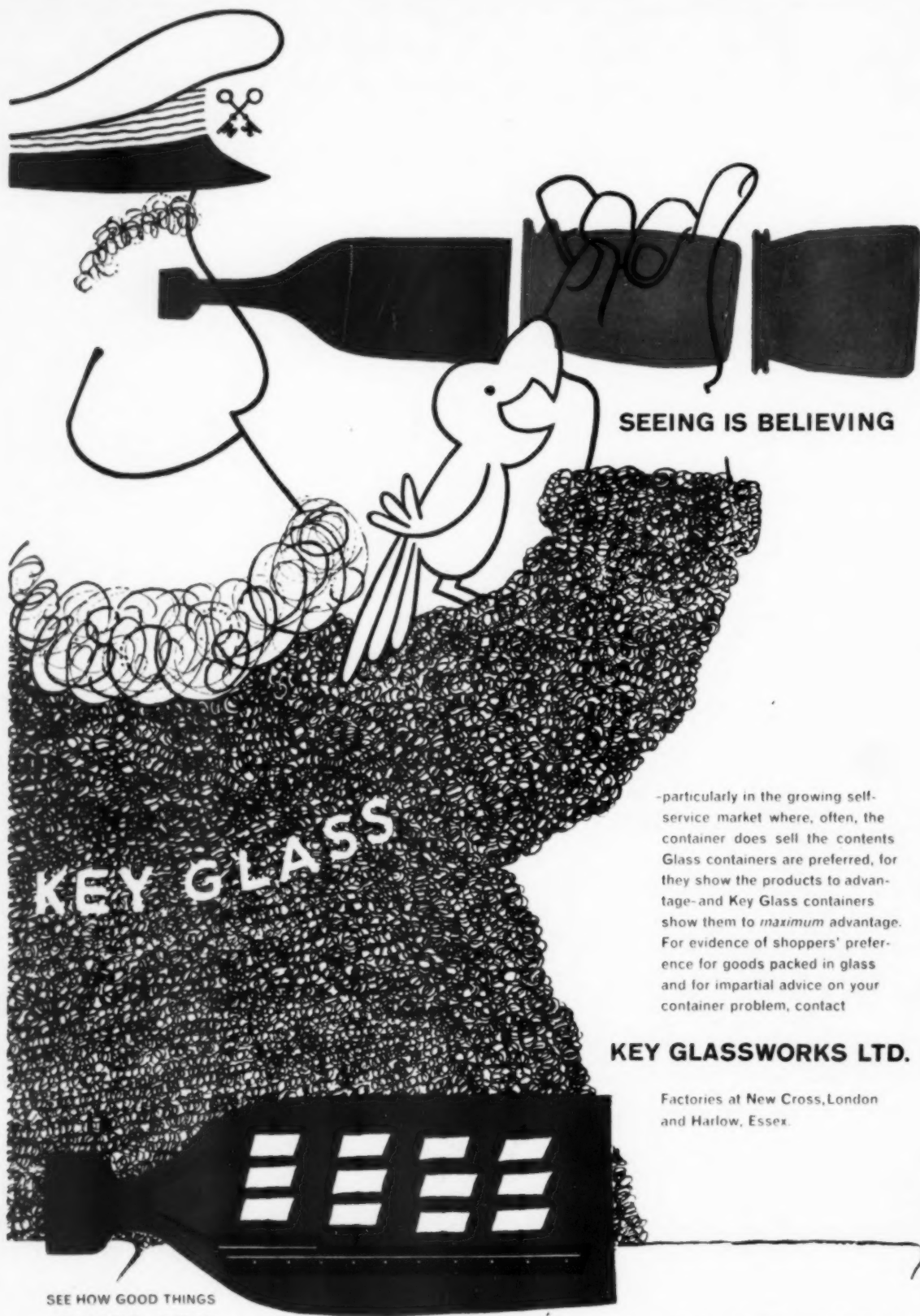
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